SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1906, by Munn & Co.]

Vol. XCV.—No. 18.
ESTABLISHED 1845.

NEW YORK, NOVEMBER 3, 1906.

10 CENTS A COPY
$3.00 A YEAR.

Length, 785 feet. **Beam,** 88 feet. **Depth,** 60 feet 6 inches. **Displacement,** 45,000 tons. **Horse-Power,** 68,000. **Speed,** 25¼ knots.

The "Mauretania" Just After the Launch.

Part of the 68,000 Horse-Power Turbine Equipment in the Erecting Shop. The Low-Pressure Turbine is 16½ Feet in Internal Diameter. The Rotating Parts of Low-Pressure and Astern Turbines Weigh Over 200 Tons.

THE 25¼-KNOT, 45,000-TON TURBINE CUNARDER "MAURETANIA."—[See page 320.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico........ $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS

Scientific American (Established 1845) .... $3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
American Homes and Gardens .... 3.00 "
Scientific American Export Edition (Established 1878) .... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, NOVEMBER 3, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE LATEST MARINE TURBINE SUCCESS.

The satisfactory completion of the trials of the turbine machinery of the "Dreadnought" has a wider significance than that of establishing the high speed of this battleship; for it marks a decided step forward in the development of the marine turbine. In the first place, the horse-power developed is considerably greater than that hitherto secured in a steamship, the largest turbine installation previous to the appearance of the "Dreadnought" being that on the Cunard liner "Carmania." Moreover, the fact that the turbines ran ahead of the contract requirements of 23,000 horse-power by an additional development of 5,000 horse-power, with a proportional increase in the speed, indicates that the serious difficulties which arose in the Allan Line steamers, and were not altogether eliminated in the "Carmania," have been now fairly well mastered. These trials, moreover, must come with a very welcome assurance to those who are responsible for the turbine engines of the "Lusitania" and "Mauretania"; for the equipment of the "Dreadnought," in which four turbines are employed on four shafts, is broadly identical with that of the new Cunard fliers, whose horse-power, however, will be three times greater. The "Dreadnought" turbines were designed to give a speed of 21 knots with 23,000 horse-power; but they actually developed 28,000 horse-power and drove the ship at a mean speed of 21½ knots, with occasional bursts of speed of 22¼ knots. The turbines of the "Lusitania" and "Mauretania" are designed to drive the vessels at 25¼ knots with 68,000 horse-power. If they exceed requirements in the same proportion as the turbines of the "Dreadnought," they should drive the new ships at a speed of from 25¾ to 26½ knots, and develop between 80,000 and 90,000 horse-power.

"CALIBER" AND "BORE."

It will be remembered that in a recent issue we explained the various uses of the term "caliber" as applied to ordnance. A correspondent now asks if we will make a similar explanation of the word "bore" as applied to shotguns; and more particularly when it is used in conjunction with a numeral, as in speaking of a 10-bore, 12-bore, or 16-bore shotgun. At the first reading, anyone who is familiar with modern rifles and heavy ordnance might think that the word "bore" here was used as a unit of length, as when we say that a 50-caliber, 6-inch, rifle is a rifle 25 feet, or fifty times the caliber (diameter of the bore), in length. But as a matter of fact, the term "bore," when applied to shotguns, is never used to indicate length, but always refers to the diameter of the bore. There is, by the way, quite an interesting scrap of history attached to the use of the term, which carries us back to an early period in the use of firearms.

In the days of our forefathers, when rifle balls were spherical, and long, cylindrical, conical-headed bullets and rifled barrels were undreamed of, the gunsmith adopted a curious but convenient method of designating the gage or diameter of the bore. He expressed it by stating how many bullets, of a size that would fit a particular musket, would go to make a pound. Thus, a 10-bore musket would be one of such a bore than ten of its bullets would go to make a pound weight; a 16-bore gun would be one whose bullets would run sixteen to the pound, and so on. Hence we get the anomaly, that the larger denomination musket has the smaller bore. Although the day of the spherical bullet has long passed away, and the only smooth-bore remaining is the shotgun, the old method of designation has been retained.

THE CARNEGIE INSTITUTION MAGNETIC SURVEY.

About twelve months have elapsed since we announced that the yacht "Galilee" of the Carnegie Institution had sailed for Hawaii, to commence her task of making a magnetic survey of the northern part of the Pacific Ocean. At the close of last year she completed her first cruise, which included the Hawaiian Islands and some of the islands which lie beyond the archipelago. On March 2 she started on a longer cruise, of some 20,000 miles of sailing, and secured the necessary magnetic observations on a voyage which included Fanning Island, the Samoan Islands, the Fiji and Marshall groups, Guam, Yokohama, and San Diego, at which port the cruise was concluded. The data thus secured is sufficient to enable the Institution to revise the existing magnetic charts of the North Pacific Ocean. It constitutes an invaluable contribution to that worldwide system of surveys by which it is hoped some day to determine the complicated laws which govern terrestrial magnetism, and thus relieve the art of navigation of one of its present sources of perplexity.

The scope of the work outlined by the Institution includes the collection of data sufficient for the revision of the magnetic charts of all the other oceans; and the yacht will shortly be dispatched on a voyage around the world, in which she will call at Valparaiso, Rio Janeiro, and Washington; cross the Atlantic to the Cape of Good Hope; and return to the Pacific by way of the Indian Ocean and the Philippines. With the elaborate observations thus secured, the Institution will be able to prepare new charts of magnetic declination embracing the complete circuit of the globe. The Institution aims at securing the necessary magnetic data in those localities where there is at present no organization engaged in surveys of this character; and as an instance of the work done by Dr. Bauer, director of the Department of Terrestrial Magnetism of the Institution, it may be mentioned that during last summer his assistants secured the needed observations at seventy stations in Canada in latitudes where hitherto few magnetic observations have been made. As the result of this work the magnetic maps of this country extend up into Canada and reach entirely across the continent.

ROADS FOR AUTOMOBILES.

The day of the much-to-be-desired special automobile roadway would seem to have come at last, for it is authoritatively announced that a company has been formed to build a special automobile course on Long Island, to be used in the annual international contest for the Vanderbilt cup, and also as a special driveway for automobilists throughout the year. The fact that the donor of the Vanderbilt cup is president of the company, and that it is promoted by some of the leading automobilists and automobile interests in the country, is a guarantee that this road will be built, possibly in time for next year's contest. Over and above the convenience and safety both of the drivers and the public which will result from the construction of such a course, this enterprise will prove to be of inestimable advantage in promoting the automobile interests of this country. When the racecourse is completed, it will be unique; for there is nothing of the kind in existence, or projected, even in Europe. Consequently, the annual Vanderbilt race will assume even greater importance than it now possesses, and the entries both for the elimination races for home manufacturers, and also of foreign contestants, will undoubtedly be larger and more representative than ever. To everyone who followed closely the races of this year, it was evident that the poor showing of the American cars was due largely to insufficient trying-out in preparation for the race; and no doubt the limited amount of trial practice was occasioned by the lack of suitable roads on which high speed could be safely maintained.

Of greater importance, however, than the construction of special racecourses is the provision of public roads suitable to the trying demands of general motor traffic. For it must be admitted that the surface of the present roads has shown itself to be quite unable to stand up under the severe usage imposed by automobiles and motor cars. In fact, the provision of suitable motor roads may be considered one of the most pressing problems of the present day. As far as the general public and, indeed, the automobilists themselves are concerned, the most serious difficulty is that of the abominable dust from which there seems at present to be absolutely no escape. As matters now stand, the only way in which to avoid dust-raising is to reduce speed to a point considerably below the present speed limit; and this is out of the question. The automobile has come to stay. It is an industry too vast, a sport too noble to be subjected to any restrictions which would ultimately kill its popularity.

Therefore, if the automobile may not be brought down to the road, the road must be brought up to the automobile, and some way found by which the dust horror may be mitigated, if not entirely removed.

So serious was the problem considered to be in England, that a royal commission on motor cars was appointed, which has recently presented a characteristically thorough and comprehensive report. It states that on the great main roads within a radius of 30 or 40 miles out of London, dust raised by motor cars "causes material damage, discomfort, and annoyance to users of, and dwellers by, the highways." Many instances of the depreciation of property are given. A real-estate agent testified that herbage, within fifty yards of the highway hedges, was absolutely useless, either for feeding cattle or harvesting. In one case, near Windsor, a house that was bought for $25,000 could not be used because of the dust, and was sold for $10,000. The person who bought it, thinking to make money by the bargain, could not sell the house at any price. A farmer stated that hay and grain crops were rendered injurious to live stock, and that cattle would seldom graze on pasture near the road.

Since the reduction of the speed of automobiles to that of horse-drawn vehicles (at which speed the dust nuisance would vanish) is out of the question, Lord Selby's commission set itself to find some means of holding the top dressing down upon the roads and preventing dust. In his report, an ample digest of which will be found in the current issue of the Supplement, the attempts which have been made and are now in progress to find a suitable form of dust-preventer for motor traffic are outlined, and the merits of the various systems of roadbuilding are discussed.

The report favors the best type of macadam roads for both heavy and light motor cars. Though such roads are not dustless, they are more nearly so than the roads composed of various local stone, which is liable to be of a friable character. For roads carrying unusually heavy traffic, a special and more costly type of construction should be used, and a system of "armoring" the road with stone blocks, which is known as the Kleinpflaster and is used with success in northern Germany, is recommended. It consists of a foundation of large inverted pyramidal stones, between and above which is laid 4 or 5 inches of small broken stone. Above this is one inch of sand, and above the sand are placed carefully selected broken stones, about 3½ or 4 inches square. These are placed with a one-half inch spacing, and compacted with a lime-sand binding of heavy consistency. This road is of great strength; is practically dustless; and its life is from twenty-five to thirty years. It costs about $18,000 per mile for an 18-foot road. Outside of this, and the paved roads laid on sand foundations as used in France, the remedy for dustlessness at present seems to consist in the use of some form of liquid tar or oil; but the serious objection to oiling is that when the dust begins to fly, as it ultimately will, it is exceedingly injurious to the clothing; while the oiled surface adheres to the feet and is carried into the home, where it is destructive to rugs, carpets, etc.

According to the report, none of the various devices employed as dust-preventers has proved to be a permanent and unqualified success, although a mixture of blast furnace slag and tar, or "tarmac," is spoken of hopefully. The hope is expressed that the government, realizing that the dust problem is of national importance, will appropriate a sum of money for experimental work.

SUCCESSFUL FLIGHT OF SANTOS DUMONT'S AEROPLANE.

On October 23, after one unsuccessful trial in the morning, Santos Dumont finally, in the afternoon, drove his aeroplane through the air a distance of 150 feet at an elevation of about 20 feet from the ground. The experiment took place near Paris, and was witnessed by a crowd of people, including representatives of the Aero Club of France. When Santos Dumont shut off the power, his machine came down so heavily on its four wheels that it demolished them. Twice the distance necessary to win the Archdeacon prize was covered. This prize, a cup, was offered for the first aeroplane which flew a distance of 25 meters (82 feet). The $10,000 prize for the first flight of a kilometer in a circle has yet to be won. Complete descriptions of Santos Dumont's aeroplane and its performance were published in our issues of August 18 and October 6 last. Fitted with a 50-horse-power, eight-cylinder motor, which drives the air propeller direct at a speed of 1,500 R.P.M., a thrust of over 300 pounds was developed. This was sufficient to drive the machine and its operator—a combined weight of over 500 pounds—forward through the air at a speed of about 25 miles per hour. According to the cabled account, the stability of the machine appeared to be good, though what it will do when flown a longer distance and in a circle yet remains to be seen. At any rate, this is the first flight of a motor-driven, man-carrying aeroplane that has been witnessed by a considerable number of people. We hope, in the near future, to be able to publish a photograph showing the aeroplane in the air. In comparing the results of Santos Dumont's experiment with those which the Wright brothers claim to have attained, there is one striking fact, viz., the young Brazilian, although having an apparatus of the same general type as that used by the American experimenters, but of about one-half its weight, found that a 50-horse-power motor was necessary to drive his flier up into the air and forward through it at a speed of 25 miles per hour; while the Wrights, with a machine of twice the weight and half the power, claim

to have made nearly double the speed (38 miles per hour).

In the experiment just described, Santos Dumont's machine lifted only about 10 pounds to the horse-power, while the Wright brothers' aeroplane, it is claimed, lifted 60, and Maxim found that it is possible to lift 133, although, in reality, with his huge machine weighing 8,000 pounds, provided with two 18-foot propellers and steam engines developing 461 horse-power, he only succeeded in lifting 20 pounds per horse-power at speeds of about 40 miles an hour. When the fact is noted that the new aeroplane has a total surface of 645 square feet (the superposed planes being 39.37 feet long by 8.2 feet wide) as against about 480 square feet of sustaining surface carried by the Wright machine (the planes in this machine are said to have been 40 feet long by 6 feet wide), if we concede the correctness of the Wrights' results, we must immediately conclude that the Dumont machine is exceedingly inefficient. The only essential features wherein it differs from the Wright flier are the use of a small, high-speed propeller (necessitated by the mounting of it on the engine shaft) and the setting of the planes at a dihedral angle. Therefore, it would appear that both these arrangements are quite inefficient.

THE INTERNATIONAL WIRELESS CONFERENCE.

BY A. FREDERICK COLLINS.

Delegates representing the governments of nearly thirty countries, convening for the purpose of drawing up regulations for the control of wireless telegraphy in times of peace and war, have been in secret session in Berlin.

This is the second international wireless telegraph congress that has convened at the suggestion of Germany. The first, it will be remembered, was held in Berlin in 1903, when it was resolved that "coast stations should be obliged to receive and forward all telegrams from vessels at sea by whatever system they might be dispatched." In order to facilitate communication between vessels and coast stations, technical explanations of the working of the apparatus are to be published.

Telegrams referring to wrecks and attempts to render assistance to vessels at sea are to be forwarded before all others. The rates for telegrams forwarded into the interior from a coast station will be those of the ordinary telegraph service plus a special charge for the use of the wireless apparatus, and will be paid for on receipt. Telegrams sent to a vessel will be paid for on board the vessel at the rates usually charged by the nation under whose flag the vessel sails. Stations are to be arranged so as to interfere with one another as little as possible, and arrangements will be made to insure correspondence in a number of technical details. Provision is made for other states besides those which sent representatives to the preliminary conference so that they may be parties to any arrangements which may finally be made for the regulation of wireless telegraphy. The most important of these resolutions is the one referring to the duty of coaling stations to receive all messages without distinction relatively to the system used. This resolution was incorporated in a protocol which was signed by the representatives of Germany, Austria-Hungary, Russia, France, Spain, and the United States. The representatives of England and Italy did not sign, for the chief reason that the navies of these countries have long-term contracts to use the Marconi apparatus exclusively, which is also true of Lloyds.

To those who so persistently clamor for the "open door" policy in wireless telegraphy, i. e., the interchange of messages between ship and shore stations equipped with whatever system, it is pointed out that Marconi secured letters patent on the fundamental principles underlying wireless telegraphy as it is practised to-day, in 1896, and further that at the very outset of the successful application of electric waves to the transmission of intelligence without wires by him, Dr. Slaby, of Charlottenburg, Germany, went to England and through the influence of the emperor witnessed the experiments.

A little later Dr. Slaby devised a system of wireless telegraphy, collaborating with Count Arco, and this and Prof. Braun's system, also a German production, were finally merged into what is now known as the Telefunken system. In every country from this time on inventors assiduously attacked the problem, presumably from the viewpoint of effecting selectivity, and the result has been an abundance of systems differing from one another and from the original in detail but not in principle.

As a matter of fact there have been only two marked improvements made in the design of wireless telegraph apparatus since it came into existence, and these are the resonance circuits devised by Lodge, and the liquid barretter invented by Fessenden. All others are merely modifications and some of them are infringements. This being true, it follows that if there is any merit in protecting inventions by letters patent, and if such protection is valid, then certainly Marconi is entitled to the fruits of his genius and his industry, which should give him a monopoly for a period, at least in this country, of seventeen years, ten of which have already expired.

It is urged that the ether is free to anyone who may care to use it. But this is beside the question. That it is free is self-evident. The interchange of messages, which is put forth so strenuously by some of the representatives, is of lesser importance. The vital point that is menacing the safety of the public is the evasion of the laws, and none are more difficult to uphold than those relating to patents.

Fortunately neither the breaking of laws nor the making of regulations can compel an inventor or his assigns to handle a competitor's products, and it is not clear how any rule can be framed that can justly compel the Marconi company to receive and re-transmit messages sent by other companies unless they choose to do so, unless indeed the wireless companies now in the field are to be considered as common carriers by their respective countries.

Last spring the daily papers reported an incident which they stated "as emphasizing the danger of giving one company a monopoly of the wireless telegraphy business, and of permitting those operating any one system to refuse to interchange intelligence with shore stations or ships equipped with another system." A recent cablegram says that the British delegates individually favor the "open door" policy if the regulations are not too rigid. Until the priority of wireless telegraph inventions can be sifted through the courts it would be well to have the opposing interests abide by a regulation that should provide merely for a compulsory interchange of messages where there is danger involving the lives of passengers on the high seas, but it need go no further.

The matter of tuning naval and mercantile marine vessels to different frequencies and the location of shore stations to avoid interference, in so far as possible, are necessary, but these are secondary questions over which no time will be lost in the present conference. No effort will be spared to induce the British and Italian representatives to agree on an unlimited interchange of messages between ship and shore stations no matter what the system installed may be, for this is the primary object of the promoters of the congress.

AERONAUTICAL NOTES.

On the 22d ultimo there was inaugurated at Pittsfield, Mass., the first balloon chase held in America. Two balloons, the "Orient" and the "Centaur," carrying two and three men respectively, ascended at 10:20 A. M. and sailed northward at a slow speed. The "Centaur" landed 30 miles away in the outskirts of Bennington, Vt., at 1:11 P. M., while the "Orient" kept in the air till 4:30 P. M. and finally landed at Jamaica, Vt., some 57 miles from the starting point. The winning balloon was piloted by Leo Stevens and carried Capt. Homer W. Hedge, president of the Aero Club of America, as passenger. Charles T. Walsh, the pilot of the "Centaur," was accompanied by Major Samuel Reber and Capt. Charles F. Chandler of the Signal Corps of the U. S. A. The "Orient" beat the "Centaur" not only in distance traversed, but also in altitude reached as well, for this aerostat ascended to a height of 8,000 feet, as against the 6,888 reached by its opponent. Contrary to what is usual in the upper air, the aeronauts found the strata unusually hot, the thermometer on the "Centaur" at one time registering 74 deg. and that on the "Orient" 106 deg. A northeast wind was blowing near the surface of the earth, and the weather was damp and chilly. After the balloons had ascended some distance a gentle air current from the southwest was encountered. This caused the balloons to change their direction and travel northward. The three automobiles which pursued them had an exciting chase. C. F. Bishop in his 45-horse-power Panhard, suffered a breakage of a driving chain and was passed by Floyd Knight in a 35-horse-power Berkshire car. The latter reached the spot where the "Centaur" landed nearly two hours after that aerostat came down. The second car to arrive at the landing place of the "Centaur" was a 16-horse-power Pope-Hartford machine, which reached the spot but 12 minutes behind the Berkshire, having consumed 4 hours and 53 minutes in chasing the balloon, the flight of which lasted but 2 hours and 50 minutes. Mr. Bishop's Panhard was 5 hours and 20 minutes in completing the pursuit. Great difficulty was found in following the balloons, as they were continually disappearing among the hills or in the clouds. The men in the "Orient" witnessed the descent of the "Centaur" at Woodford, some three miles east of Bennington, and dropped a note as they passed over the latter place, telling where the larger balloon had landed. It was this information that made it possible for the pursuers to locate the aerostat, after they had all but given up the search upon arriving at Bennington at 2:30. The army officers who went up in the "Centaur" obtained considerable valuable data which they expect to turn in to the chiefs of their departments, with the hope that the War Department may experiment with balloons and airships for its own use, as is done by the war departments of most of the foreign powers.

Besides the successful experiment of Santos Dumont with his aeroplane on the 22d ultimo, we have to record some further experiments made by M. Vuia at Issy-les-Moulineaux, France, on the 7th of October. M. Vuia's machine, which was illustrated and described in our issue of March 24, consists of two large wings having a spread of 215¼ square feet. These wings, which can be folded up, are held rigid when in use by steel ribbons. They are slightly concave, and have a purely geometrical shape. They are mounted upon a framework, which is carried on pneumatic-tired wire wheels, forming a quadricycle. The apparatus is propelled by a special carbonic-acid gas motor, which is nothing more nor less than an ordinary Serpollet engine, and is run on the heated vapor from the liquid carbonic acid. The heating of the gas keeps it from congealing, due to its own expansion, and also increases its pressure by superheating it. By combining the heating of the gas with the admission of the same to the cylinders, the experimenter has a double means of varying the pressure on the pistons, and hence the power of the motor. The cylinder contains 22 pounds of liquid carbonic acid, which is sufficient to run the motor at its full capacity (25 horse-power) for five minutes. The propeller, which has a diameter of 7.21 feet and a pitch of 7.71 feet, is mounted directly on the end of the shaft, and gives a thrust of 130 kilogrammes (286 pounds) when the engine is making 900 R. P. M., and the apparatus is held stationary. To develop this speed the engine requires a pressure of 143 pounds to the square inch. The total weight of the apparatus and operator is about 550 pounds. On the date mentioned, M. Vuia, in the presence of the officials of the Aero Club of France and a considerable crowd of onlookers, succeeded in getting his machine to rise in the air by bounds of about two-fifths of a second duration.

Experiments have also been carried on recently in France by M. Cornu with a helicopter, which consists essentially of two propellers on a vertical axis. These raise the apparatus and advance it by blowing the air which they displace against suitably disposed aeroplanes. The model tested was fitted with a 2-horse-power Buchet motor, which revolved propellers of 2.25 meters (7.38 feet) diameter. The weight of the entire apparatus was 13.75 kilogrammes (30¼ pounds). In the first trial the apparatus rose vertically with great facility; while in the second trial, after the planes had been inclined to produce forward motion by the effect of the reaction of the air upon them, the apparatus, which was attached to a central axis, was made to describe, in the free air around this axis, a circular orbit 75 feet in diameter.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1609, opens with an article by our English correspondent on a huge dredging plant for service in India. The dredger in question has a bow of triple form constituting two wells, in which rotary cutters are mounted for excavating hard material. Underneath and to the rear of these cutters are suction pipes. Excellent illustrations accompany the article. An admirable discussion of dustless roads for motor traffic is published. Mr. Walter J. May writes on the making of foundry patterns. The third and last installment of the digest of the regulations and instructions concerning the denaturation of alcohol appears. Dr. Otto Roehm discusses the modern manufacture of illuminating gas. In view of the recent important announcement that tungsten incandescent lamps are to be manufactured in this country on an extensive scale, the exhaustive article on the tungsten lamp which appears in the current SUPPLEMENT will be read with interest. Messrs. Herbert J. Webber and Walter Swingle contribute an article on new citrus creations of the Department of Agriculture. The new fruit which they have succeeded in evolving is called the "citrange," and possesses some of the properties of the orange and some of the lemon.

MANUFACTURE OF IRON IN CHINA.

Iron in China is made by mixing four parts of the ore, one part of decomposed coal dust, and one part of small coal. The mixture is placed in crucibles each about 18 inches deep and 6½ inches in diameter. The crucibles are heated in a furnace having walls about 3 feet high and a floor 4 feet by 6½ feet, which is covered with clay and spread with a layer of coarse coal to a height of 7 inches or 8 inches above the clay. The furnace holds about sixty of these crucibles. The space between them is filled with small coal, and on top is placed a 3-inch layer of small coal, followed by a layer of cinders and ashes of the same depth. About sixteen hours of strong heat suffices to convert the mixture into a mass of carbon iron, says the Iron Age. This is made into wrought iron by reheating over a wood fire and by hammering it when red hot.

THE 25¼-KNOT CUNARD LINER "MAURETANIA."

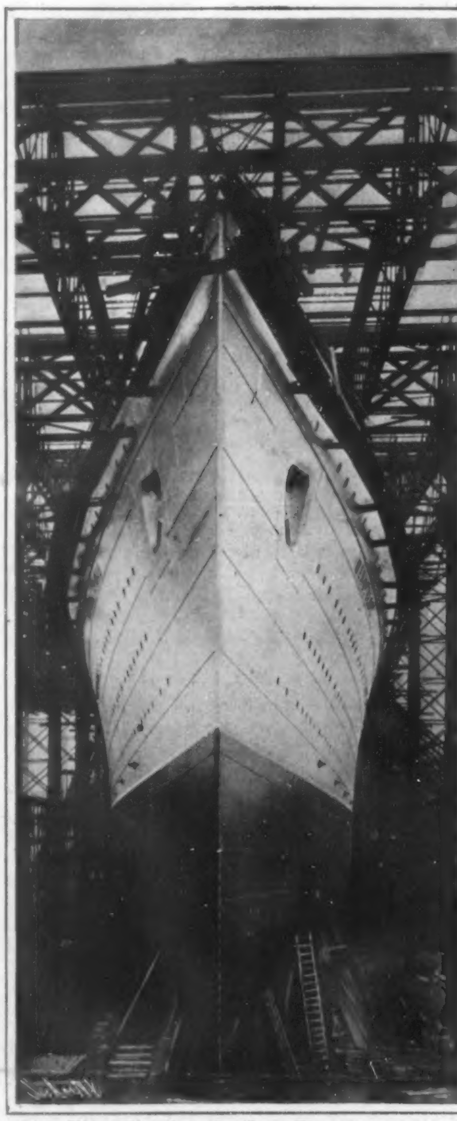
The "Mauretania," the second of the new 25-knot turbine liners which are being built for the Cunard Steamship Company, was recently successfully launched at the yards of the builders, Swan, Hunter & Wigham Richardson. The contract of the Cunard Company with the British government binds them to build two liners, to average 24¾ knots, which are to be retained at the call of the Admiralty in case of war. In return the government advances a sum of $13,000,000 for the construction of the ships at 2¾ per cent interest, and the government also makes an annual payment of $750,000 to the company. The literal terms of the contract are that the vessels shall make 25¼ knots on trial, and that within a year of taking their place in service they shall make a round trip to New York and back at 24¾ knots.

The "Mauretania" is identical with the "Lusitania" except in minor details. The form and dimensions of the ships are based upon tank experiments at the government tank at Haslar; but these experiments were supplemented by the builders, who constructed a 40-foot 6-inch launch, which was of the same general form as the big steamship; and with this, elaborate tests were made on variations in the form of the stern and in the design of the propellers. As a result of these experiments the outer propellers have been placed somewhat farther ahead of the inner propellers than in the "Lusitania," and the shape of the propeller blades is slightly modified. The dimensions of the "Mauretania" are as follows:

Length over all	785 feet
Length between perpendiculars	760 feet
Beam extreme	88 feet
Depth molded	60 ft. 6 in.
Gross tonnage	33,200 tons
Net tonnage	11,900 tons
Maximum draft	37 feet
Displacement at this draft	45,000 tons

These dimensions render these vessels by far the largest ever built or projected. They are 78 feet 6 inches longer than the swiftest of the big liners, the "Kaiser Wilhelm II.," and they are to show a speed 1¾ knots greater. They are 80 feet longer even than the "Great Eastern," and of 5 feet greater beam.

The "Mauretania" has nine decks—the lower orlop, the orlop, the lower, the main, the upper, the shelter, the promenade, the boat, and the sun deck. The motive power, including engines, boilers, and coal bunkers, occupies 420 feet of the mid-length of the vessel from the main deck to the hold, and therefore it can be readily understood that there is practically no space for cargo, the vessel being purely a mail and passenger ship. The passenger accommodation is provided on the six decks above the water line, from the main deck upward. The shelter deck is given up to the officers and crew, the latter being forward and aft. On this deck also are specially isolated hospitals. A feature which will be greatly appreciated by invalids and those who may be temporarily indisposed, is the provision of two electric passenger elevators at the center of the ship, with landings at each of the six passenger decks, an innovation first proposed by the



Bow View, Showing the Very Fine Entrance and Lofty Freeboard.

Scientific American for these vessels. The ship will carry 560 first-class, 500 second-class, and 1,200 third-class passengers, and a crew of 810, making a total number of souls on board of 3,070. In general the staterooms will be 9 feet in clear height and in the saloons the height will be about 10 feet 6 inches. Another novelty in the "Mauretania" is that the promenade and boat decks overhang the shelter deck by 21 inches on each side of the ship, this being done to bring up the width of the promenades on each side of these decks to 18 feet. The boat deck is 33 feet above load water line. The top of the wheel house is 63 feet, and the funnels are 115 feet above the same level.

The hull is divided by fifteen transverse bulkheads and the coal bunkers are themselves water-tight and divided by bulkheads. The subdivision is such that these ships could not be sunk by a single collision. Every door of the compartments can be closed, in the event of collision, by the Stone-Lloyd hydraulic system; and this can be done by the officer on the bridge, or from any one of several positions throughout the ship.

The flat keel is built up of plating varying in thickness from 1 inch to 1¼ inch. In all plating the holes were electrically drilled, and the riveting was done by hydraulic power. The ship has a complete double bottom throughout her length, the depth between the outer and inner bottom being 5 feet. The bilge is well rounded and the entrance lines, as is evident from the accompanying view of the vessel bow on, are exceedingly fine.

It is needless to say that the framing of the ship is exceptionally deep and stiff. Amidships it consists of channel bars, with deep web frames at intervals. These heavy frames are grouped where the stresses will be greatest, notably in the wake of the machinery spaces. The channel bars extend from the double bottom (which, by the way, is carried well up into the bilge) to the shelter deck, which is 60 feet 6 inches above the keel. The plating of the hull is unusually heavy, each plate weighing from 2½ to 3 tons. At the turn of the bilge and on the sheer strakes they are made much heavier and weigh from 4 to 5 tons apiece. Here, also, the plating is doubled, and steel of higher tensile quality is used, the object being to give the sides of the ship additional girder strength by increasing the weight of the material along the top and bottom chords.

The weights and sizes of the various parts are necessarily very large, the stern frame and brackets, for instance, weighing altogether 150 tons. The rudder head is of steel, 25 inches in diameter. There is one gudgeon only on the stern framing, and the pintle is of immense size, weighing over 1¼ tons.

Perhaps the greatest interest attaching to the "Mauretania" centers in her turbines, which are being constructed by the Wallsend Slipway and Engineering Company. The motive power, it will be remembered, is developed on four shafts, each carrying one propeller. The two outer shafts are driven by two high-pressure turbines and the two inner shafts by two low-pressure turbines. At the after ends of the low-pressure turbines, and on the same shafts, are located the turbines for driving the ship astern. The inner shafts turn outward and the outer shafts inward. The total contract power is 68,000 divided equally upon the four shafts. The speed of revolution is to be about 200.

We direct attention to the very interesting photographs of the turbine plant, which give an impressive idea of its vast proportions. Thus the high-pressure turbine has an internal diameter of 10 feet and is over 25 feet in length, while the total length from the forward end of the low-pressure turbine to the after end

(*Continued on page 323.*)

Stern View, Showing Two of the Four Propellers.

Note the fine lines of the afterbody.

The Boiler Equipment, Consisting of 25 Cylindrical Boilers 17 Feet 8 Inches Diameter by 21 Feet Long.

They contain 192 furnaces, 160,000 sq. ft. of heating surface. Upon their 4,000 square feet of grate over 1,000 tons of coal will be burned daily.

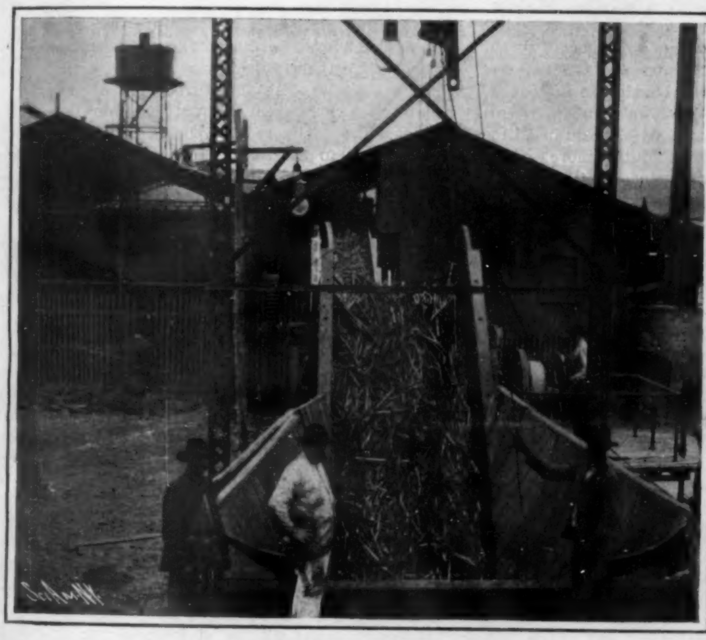
THE 25¼-KNOT, 45,000-TON TURBINE CUNARDER "MAURETANIA."

SUGAR MAKING IN CUBA.

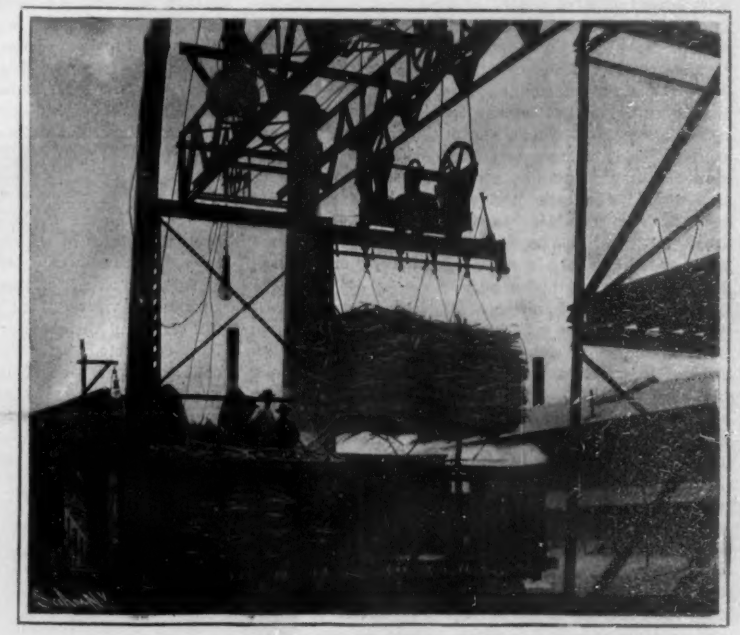
BY DAY ALLEN WILLEY.

One result of the increase of American interest in Cuba since the close of the Spanish war has been the development of the sugar industry on a very extensive scale. In fact, the number of sugar plantations and mills operated by people from the United States, and the enterprises projected, indicate that the annual tonnage of sugar manufactured on the island will be greatly increased in the near future, and that it will far exceed any other country in the production of this staple. Since 1902 the increase in the output has been no less than 30 per cent. At the present time it is contributed by 179 estates or plantations, of which two have an annual production of over 25,000 tons each, six ranging between 20,000 tons and 25,000 tons, seventeen between 15,000 tons and 20,000 tons, and fifty-eight between 7,000 tons and 15,000 tons.

General View of a Sugar Estate Owned by Americans in Cuba.

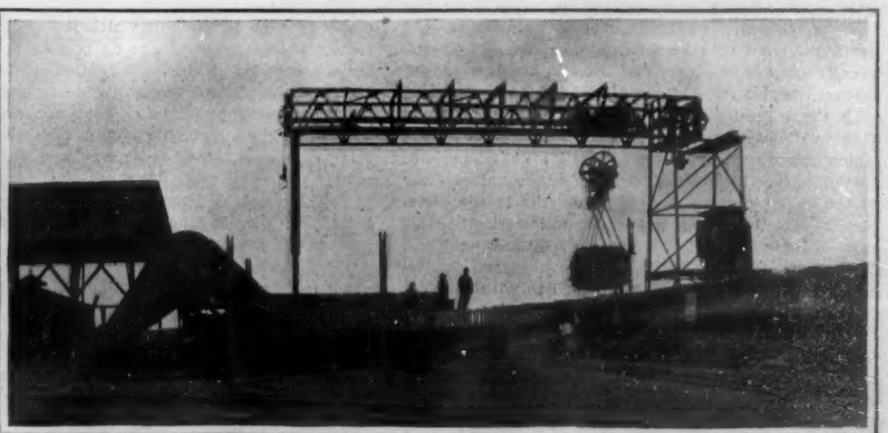


Cane Lowered Into the Mill.



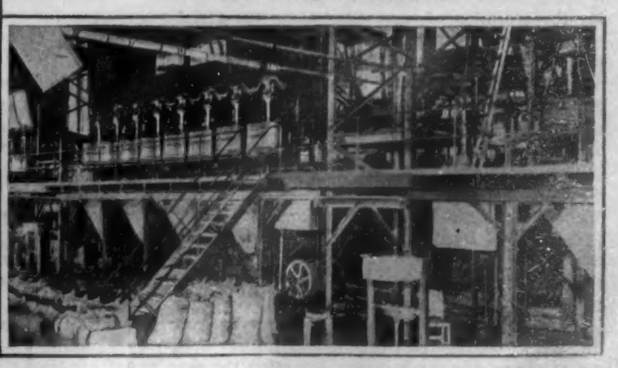
Lifting Cane From the Car.

Loading Cane on Ox Carts.



A Modern Sugar Cane Hoist.

Francisco Sugar Mill. One of the Oldest of the "Centrals" in Cuba.



The Centrifugal Separators.

SUGAR MAKING IN CUBA.

According to statistics compiled by the Cuba Review in every part of the republic, the province of Havana contains nineteen estates with an annual capacity of 181,000 tons; Pinar del Rio, six representing 28,000 tons; Mantanzas, fifty-two with 362,500 tons; Santa Clara, seventy-one with 537,000 tons; Puerto Principe, three with 35,000 tons; and Santiago, twenty-eight with 265,000 tons. The total output for 1906 will exceed 1,000,000 tons. These figures indicate how widely the industry is distributed, showing that the sugar planter has begun operations practically in all parts of the island.

One factor of superiority is the soil. It is of such fertility, that the cane field is planted at the present time only about once in ten years. Experienced American growers say that there is no necessity ever to plant more than once if care is taken in cutting the cane at harvest time, not to pull up any of the roots, as the new cane will immediately sprout from these. The Cuban cane is of such a size, and contains such a quantity of saccharine matter, that ten tons are calculated to produce one ton of sugar if treated by the latest mechanical processes. Consequently, a single plantation of 1,000 acres may yield 3,000 tons of the commercial article under fairly favorable conditions.

Compared with other countries producing cane sugar, it is claimed by experts in the industry that where modern methods of agriculture and manufacture are employed, the yield of a given area in Cuba will exceed that of a similar area in any other district, owing to the fertility of the soil, and especially to the fact that the climate here permits the continuous cutting of the cane and the extraction of the juice for a period ranging from 150 to 200 days—a longer sugar-making season than elsewhere. Consequently, at the larger "centrals" or sugar houses, equipped with modern machinery, the cost of production has been reduced to such a figure that, including the cost of the cane and all other expenses, it is actually less than 1½ cents a pound for the centrifugal sugar of 96 degrees standard. These figures are based upon the actual operation of one of the largest estates on the island.

The mechanical processes which have so lowered the cost have been greatly improved in recent years, so that by the present system all of the work is done by machinery at a modern "central," from the time the cane is loaded upon the plantation cars until the sugar is bagged for the refinery and the liquid residue run off into casks or into the hold of the tank steamship. In the old days of the industry the cane was unloaded and carried by hand to the crushing rolls, or transferred by means of what might be called slings operated by hand. As the refuse cane is used for fuel, and the mill must receive a certain supply continually when in operation in order to get the best results, a new device has been invented for handling the cane. It is the invention of Mr. H. J. Kiely, and consists of a trolley passing along an aerial way, from which is suspended a series of chain slings to which are attached automatic trip hooks. As the train of cane cars is moved along the track under the device, the ball of the hoisting machine is lowered over the top of the load, and the chain slings are introduced under the bottom of the cane and fastened with the trip hooks. The bottom of the car is provided with wooden strips spaced four inches apart, which form grooves through which the chains are passed under the load. The load is then raised clear of the top of the car, and while moving in the direction of the receiving hopper is automatically half turned, in order that the cane may be delivered end down instead of lengthwise. When the load is suspended over the hopper it is lowered to within a foot of the bottom of the hopper, and the attendant by controlling the machinery automatically opens simultaneously all the slings under the bottom of the load, which falls into the hopper. The slings are then raised by power, and the carriage travels back to take up another load in the same manner. The device works so rapidly that only three minutes are required to sling, raise, and discharge six tons of cane, including the operation of the trolley along the aerial way.

Thus the raw material is fed continuously to the mill through the receiving hopper or directly to the conveyor serving the crushing rolls. The "trapiche," as the Cubans term the grinding mill, is usually equipped with eight rolls, the first being corrugated. They are set at distances ranging from one-half to one-eighth of an inch apart, each roll being from six to seven feet in length and forty inches in diameter. When at full speed they make about two revolutions per minute. By this system the cane is generally crushed or macerated to such a degree that it is necessary to pass it between the rolls but once, as fully 75 per cent of the juice is extracted. The refuse or bagasse is then taken to the furnaces by means of an endless conveyor. The grinding mill is driven by steam power, the same engine actuating the cane and the bagasse conveyors, so that a uniform speed is maintained.

At present, by means of improved furnaces, or "bagazo burners," the material is burned green, or just as it comes from the conveyor. The introduction of these furnaces, and the consequent saving of time and labor, mark one of the great epochs in the progress of economical sugar making, second only in importance to that of the "triple effect" apparatus. Economy in firing the boilers is one of the greatest considerations, as will be realized when it is stated that the large centrals require for their operations batteries of boilers of from 1,000 to 5,000 horse-power.

The juice flowing from the "trapiche" is pumped either directly into receptacles called defecators, or is first passed through an intermediate apparatus called the "calentador," or heater. The object of this heater is to raise the temperature of the juice from about 80 deg. Fahr., as it comes from the mill, to 100 or 112 deg. by the utilization of waste heat, before delivering it to the defecators. The latter are cylindrical copper vessels, with semi-spherical bottoms, placed in cast-iron jackets, which leave a space between them and the copper bottom. Into this space steam is admitted and the juice heated. The defecators vary in size, having generally a capacity of from 1,000 to 1,300 gallons each, and are arranged in line. A capacity of 1,300 gallons (nearly 180 feet) is sufficient to treat the juice obtained from 100 tons of cane ground in the twenty-four hours.

While the defecators are being filled to within a few inches of the top, steam is gradually admitted. Before reaching the desired level, a solution of lime is added, and the whole is thoroughly agitated. The lime used must be of the finest quality; about 7 to 15 pounds are necessary for a defecator of 1,000 gallons capacity. The best temperature at which to introduce the lime is about 190 deg. Fahr. It takes about twenty minutes to fill a defecator, and, with steam of 55 to 60 pounds pressure, in fifteen minutes more, or a total of thirty-five from the commencement of operation, scum, or "cachaza," begins to form on the surface and the steam is shut off. The juice is thus separated into three layers, the lowest being very thick and turbid, composed of precipitates of insoluble salts, earthy matter, lime, etc. The volume of these substances varies much, according to the quality of the cane and the manner in which the defecation has been conducted, amounting generally to from ¼ per cent to 2 per cent of that of the crude guarapo or syrup. On the surface are albumen, lime, and woody matter. Between these two lies the purified juice, clear, transparent, and of golden color. The solution is allowed to remain ten or fifteen minutes, after which a cock is opened, which allows the turbid fluid at the bottom to be drawn off into a receptacle. When this is done the direction of the cock is changed, and the purified juice is drawn off into a different receptacle until the scum is reached, when that also is drained away separately. The defecator being now empty is ready to receive another charge, and the routine is repeated. The entire round of operations consumes about one hour for each charge.

The scum and turbid residue still contain a considerable portion of juice, of which it is desirable to extract as large a percentage as possible. To this end the scum is led off to scum kettles—rectangular iron tanks furnished with serpentine steam pipes. In these the scum is subjected to a defecation similar to the first, with certain modifications. The clear juice derived from this second treatment is added to that obtained from the first. The remaining scum is then passed through a filter press, and nearly all of the remaining juice is squeezed out and also added to the previous product.

The grosser impurities of the juice, amounting to about 40 per cent of its total weight, having been eliminated by the defecation, the next step in the treatment is concentration by evaporation. This is accomplished in the triple or multiple effect apparatus, which consists of three or more cylindrical vessels, into which the purified juice is delivered from the defecators. In these vessels a vacuum is formed by means of a condenser and air pump. Into the first vessel exhaust steam from the engines and pumps is admitted, this containing enough heat to cause the juice to boil, as atmospheric pressure has been removed. The hot vapors produced by this ebullition are passed over to the heating surface of the second vessel, causing the juice which it contains to enter into ebullition also. The vapors from this second vessel are, in turn, passed over to the heating surface of the third, or fourth, with the same result. This series of operations recalls that of the triple-expansion steam engine, the object in both cases being the economy of heat.

There are several indispensable accessories to this process, the most important being the air pump. This is a heavy and powerful machine, and is built in both vertical and horizontal designs. The condenser, by means of which the vapors from the last vessel are condensed, is another important adjunct. Other pumps are also required—one to raise the defecated juice from the defecators to the multiple effect, and another to remove the condensed vapors and accompanying hot water produced by the action of the condenser from the hot well and deliver them to the cooling tower. These pumps may be independent horizontal engines or worked from the engine of the air pump.

After being evaporated the syrup is sometimes subjected to a clarification, but opinions differ regarding the advantage of this process. When it is practised, the syrup is run into a clarifier, where it receives another boiling and addition of lime, by means of which more scum is separated and removed by skimmers. Either with or without this clarification the syrup is ready, on leaving the evaporators, to be introduced into the vacuum pan to be crystallized. There are many forms of vacuum pans, all founded upon the same principle of concentrating the syrup by further evaporation, and then adding more syrup of lower temperature to produce crystallization. This addition of colder syrup is continued until the vacuum pan is filled with crystals of sugar, containing also certain impurities and about 10 per cent of water. The whole is called the "masa cocida" in Spanish, and "masse cuite" in French. It consists of: Sugar, 75 per cent to 87 per cent; foreign matters, 15 per cent to 5 per cent; water, 10 per cent to 8 per cent.

The final operation is purging the "masa cocida," by placing it in a suitably designed machine called the "centrifugal," where, by rapid revolution, from 20 per cent to 30 per cent of the total mass, consisting of the water, impurities, and some uncrystallized sugar, is separated and thrown off as molasses. Before charging the "masa cocida" into the centrifugals, it is first delivered to the "malaxar," or mixer. This consists of an iron vessel traversed by a shaft upon which are blades. As this revolves, the hot mass is stirred up and prevented from becoming set. The mass is either delivered by pumps directly from the vacuum pans to the mixer, and fed thence, still hot, to the centrifugal, or it is allowed to stand and cool for two or three days before being placed in the mixer. In this latter case the solidified mass is first broken up in a special machine called the "triturador" before being placed in the mixer. This process is called "cold purging."

When the mass is charged in the centrifugal, the latter is made to revolve, at first very slowly, but more and more rapidly up to 1,000 or 1,500 revolutions per minute. By this rapid motion all the molasses is thrown off in from one to fifteen minutes, according to circumstances, and the motion is then gradually arrested. The sugar that remains is known as "first sugar," of 96 per cent polarization, and can be placed at once in bags for the market. It may amount to about 65 per cent of the total "masa cocida." The residue is placed again in the vacuum pans, and subjected to a treatment similar to that already carried out, with certain modifications. This results in the production of "second" or "molasses sugar," after going through the centrifugal again. This second sugar will be of from 85 per cent to 90 per cent polarization. In some plants the second residue is passed again through the vacuum pans, but generally it is distilled into rum. The result of the whole treatment may be as follows: "First" sugar, 65 per cent; "second" sugar, 9 per cent; molasses, 26 per cent.

As we have intimated, some of the most extensive plants in the world for manufacturing "raw" sugar are now being completed in Cuba. The principal one, and by far the largest, is located on Nipe Bay on the northeastern coast. It was designed by American engineers, equipped with American machinery, and is owned entirely by American capitalists. When all its machinery is in operation, it will have a maximum grinding capacity of 5,000 tons of cane every twenty-four hours—nearly double the capacity of any similar plant. To serve this mill 800,000 tons of cane will be required in a season. The company owns 130,000 acres of land, of which 30,000 acres will be cultivated exclusively to supply the Central, whose annual output is estimated to be at least 80,000 tons of sugar, not including the molasses and other by-products which will be secured by the processes employed. To operate the several divisions of the works, 9,000 horse-power will be necessary. It will be supplied by a battery of fifteen units of 600 horse-power each. To serve the mill and adjacent estate, fifteen miles of railroad are being constructed, to be provided with one hundred and seventy-five cane cars and seven locomotives. The cars will be loaded as well as unloaded entirely by power appliances.

Comparing boiler explosions in England and the United States, Consul Halstead stated that during the twelve months ending June 30, 1905, there were 14 persons killed and 40 injured from British steam plant accidents; in the United States 383 persons killed and 585 injured. The number of steam boilers in the United States does not exceed by more than 50 per cent those in Great Britain, so that, in comparison, the actual percentage is ten times as great in the United States as in England.

THE 25¼-KNOT CUNARD LINER "MAURETANIA."

(*Continued from page 320.*)

of the astern turbine, which is placed immediately after the low-pressure, is not far short of 100 feet. The low-pressure turbine casing is a truly enormous piece of work, having an internal diameter of 16 feet 6 inches. This, be it noted, is slightly larger than the diameter of the Rapid Transit tunnel tube below the East River. It is estimated that the weight of the rotating parts of the low-pressure and astern turbines combined is more than 200 tons, and yet so accurately is the work being done that the methods of lining up adopted provide for an adjustment of this 200 tons of about 1-3,000 of an inch. Moreover, although the circumferential speed will be about 11,500 feet per minute, there will have to be a minimum clearance in the high-pressure of 0.1 inch between the blades and the surface of the casing. All the casings of the turbines are of cast iron, while the rotors and dummies are made of Whitworth fluid-pressed steel, as are also the disk wheels of the rotors. The low-pressure rotor is 12 feet in diameter. The casings are fixed to the bedplate at one end, but the other end is free to slide longitudinally in slipper guides under expansion and contraction. Other dimensions showing the great size of the turbines are those of the exhaust ports from the low-pressure casing to the condenser, which measure 11 feet by 16 feet in the opening. The blades of the turbines vary from a few inches in length at the admission end of the high-pressure turbine up to a maximum length of 22½ inches at the exhaust end of the low-pressure turbine. The high-pressure turbine shafting is 27 inches and the low-pressure 33 inches in diameter.

One of the most striking of our engravings is that showing the twenty-five cylindrical boilers which are necessary to supply steam to the above-described turbines. Twenty-three of these boilers are double-ended and two are single-ended, and between them they carry 192 furnaces. The double-ended boilers are 17 feet 3 inches in diameter, and 21 feet long. They are to work under the Howden forced-draft system. Between them they will have 160,000 square feet of heating surface and nearly 4,000 square feet of grate area. The pressure at the boilers will be 180 pounds and at the turbines 160 pounds. The boilers will be in four separate stoke holes with seven boilers in the forward stoke hole and six in each of the others. In our illustration the boilers are shown arranged in the erecting shop exactly as they will stand when looking athwart the ship. For each group of six boilers there will be a smokestack which will extend to a height of 152 feet above the keel of the ship, and these smokestacks, which are elliptical in section, measure 17 feet 6 inches by 23 feet 6 inches.

The launching weight of the "Mauretania" was 16,500 tons. When loaded to her maximum draft of 37 feet, she will weigh about 45,000 tons. She will be ready for her steam trials in the summer of 1907, when, as we have said, she must make 25¼ knots. That she will do so is rendered probable by the successful performance of the turbines of the "Dreadnought" which are similar in design, and went 5,000 horse-power above the contract.

The "Ville de Paris"—A New French Airship.

Among the recent airships which are being constructed in the vicinity of Paris we may mention the "Ville de Paris," which will no doubt soon be ready to enter the field. M. Henry Deutsch, senator and well known for the aeronautic prizes he founded in France, is having the new airship built by Surcouf, and it has been in construction for some time past. Some of the main features are as follows: The dirigible is 62 meters (203.42 feet) long, and its largest diameter is 10½ meters (34.45 feet). Its capacity is 3,200 cubic meters (113,800 cubic feet). Built of double rubber-coated tissue with an interior protecting coating, the balloon ends in a balancing tail, designed according to the plans furnished by Col. Renard, and the aeronaut Henri Hervé. This part will be one of the original features of the new balloon, and is intended to give it steadiness as well as a good steering. It is made up of a set of eight canvas tubes filled with hydrogen and attached behind the main body. Col. Renard's method is used for building the main part of the balloon, according to his recent theories. This is formed of a middle cylindrical part, with a conical cap at each end. The whole is designed so that the pieces of tissue are joined together without having any longitudinal seams, and in such manner that the seams are relieved of heavy strains. As to the nacelle, which is suspended below the balloon, it is formed of a framework 105 feet long and carries an Argus 4-cylinder gasoline motor, giving 70 horse-power at 900 R. P. M. A reducing gear having a gear ratio of 5 to 1 connects the engine to the propeller shaft. The propeller is placed at the front end of the framework. This propeller is entirely new, and is constructed after the technical conceptions of Col. Renard. It has two blades, which are set in the hub in such a manner that they can be freely turned. The setting of the blades to the proper pitch is accomplished automatically, and is dependent upon the thrust. In other words, it is an automatically variable propeller. The tests of this propeller by different engineers have led them to hope for excellent results.

Early Observations of the Sixth Satellite of Jupiter.

It is pointed out in one of the Harvard College Observatory Bulletins that the photographs of Jupiter will probably furnish early positions of the sixth and seventh satellites, as soon as approximate positions are computed for these dates. This has accordingly been done, by Prof. W. H. Pickering, and the positions of the sixth satellite marked upon six of the plates. The required measurements, and their reduction, were assigned to Miss Leavitt. It then appeared that in examining some of these plates, on December 10, 1904, she had already marked and measured the sixth satellite, but had concluded that it was probably an asteroid near its stationary point. On the eight plates taken from June 26 to July 1, 1899, it appeared to be moving with Jupiter, but was identified on a plate taken July 12, 1899, and found to have increased greatly in speed during twelve days. Unfortunately, Jupiter was off the edge of the plate, and it was assumed that the satellite had moved away from it, while in fact the distance between them was actually less than it was a fortnight earlier. It would appear, therefore, that had the true character of the object been recognized, the announcement made by the Lick Observatory on January 5, 1905, would have been anticipated. This statement is made as having perhaps a certain historical interest, and with no thought on Miss Leavitt's part of claiming any share in the discovery of Prof. Perrine. On the contrary, it illustrates the fact, familiar in every branch of science, that an object may frequently be seen, and yet may fail to receive that recognition of its significance which constitutes its true discovery. The sixth satellite has been found on two plates taken in 1894, and on nine taken in 1899. An excellent plate taken with the 8-inch Bache telescope on July 23, 1889, and having an exposure of 60 minutes, was also examined, but the satellite was not found, owing, probably, to the light from Jupiter, which fogged the plate, and obscures the faintest stars in the region. The faintness of the satellite, in some cases, rendered its measurement a matter of no little difficulty. On the other hand, the images of the catalogue stars, used for comparison, are very large on account of the long exposures of the plates, thus making possible appreciable errors, both systematic and accidental. For this reason, a faint star near the satellite was measured on every plate, and it may be expected that systematic errors of measurement will affect the positions of the two objects equally, if they are comparable in shape. Usually, the images of the star and the satellite do not differ greatly in character, as is shown by the description of each, written during an independent examination of the plates.

An alloy of 60 parts copper, 1 part tin and 39 parts of zinc, is found to offer great resistance to the action of sea water, and has been largely used in naval construction.

THE CREATION OF A STAR.

The Great Nebula in Orion. One of the First Nebulous Masses Which Were Spectroscopically Examined by Sir William Huggins.

THE CREATION OF A STAR.

Eras ago a great fiery mist extended into the limitless spaces of the heavens for millions and millions of miles—a mist so hot that its fierce temperature could not be measured by any human instrument and could be roughly computed only by involved mathematical processes. That mist spun with a frightful speed, and as it spun it cooled and shrank. During its contraction it spun still more swiftly—so swiftly indeed, that a moment at last came when the tremendous centrifugal force which had been developed overcame the contraction caused by cooling, and hurled off a ring from the glowing mass. With continued shrinkage, the centrifugal force increased. Other rings were flung off. These rings, still gleaming with heat, contracted about their densest portions into spheres, and these spheres in their turn hurled rings into space—rings that condensed into smaller spheres and revolved about the bodies from which they had sprung.

It is thus that Laplace conceived the origin of our solar system, and that conception, despite the modifications to which it has been subjected, is still accepted under the name of the Nebular Hypothesis by most astronomers.

The spheres first split from the glowing rings are our planets; the smaller spheres their attendant satellites. Other solar systems, probably even grander in their scope, are even now undergoing a similar process of formation in regions of the heavens unpenetrated as yet by our most powerful lenses.

How many years were consumed in the creation of our sun, our earth, the moon, and the stars, no one can even guess. That millions of years were required is at least certain. So slow is this creation of a star, that astronomers long ago fancied some evidences of its various stages might still be discovered in the sky. Naturally the rings of Saturn were first selected as one piece of evidence. But inasmuch as these very rings had suggested the Nebular Hypothesis it would clearly have been absurd to cite them as a proof of the truth of Laplace's conception. On the other hand, no change could be detected with the telescope in those stellar masses where shrinkage into a globular form might be most reasonably supposed to occur. Nor is this at all astonishing. So slowly did the original fiery mist congeal, that even in the period of ten thousand years no appreciable change would have occurred; and since telescopes have been in use for scarcely three centuries, signs of any transformation were not likely to be discovered by its means. Moreover, so enormous is the abyss that separates us from many a star that the light of the star traveling at the rate of 186,000 miles in a second reaches this earth only after the lapse of centuries. In a word, we see many stars not as they really appear, but as they were when Columbus discovered America. Clearly, the telescope can help us but little in its examination of bodies so distant.

Fortunately, we have at hand in the spectroscope an instrument more exquisite in its refinement—an instrument which enables us to analyze the elements of a remote blazing luminary with startling precision.

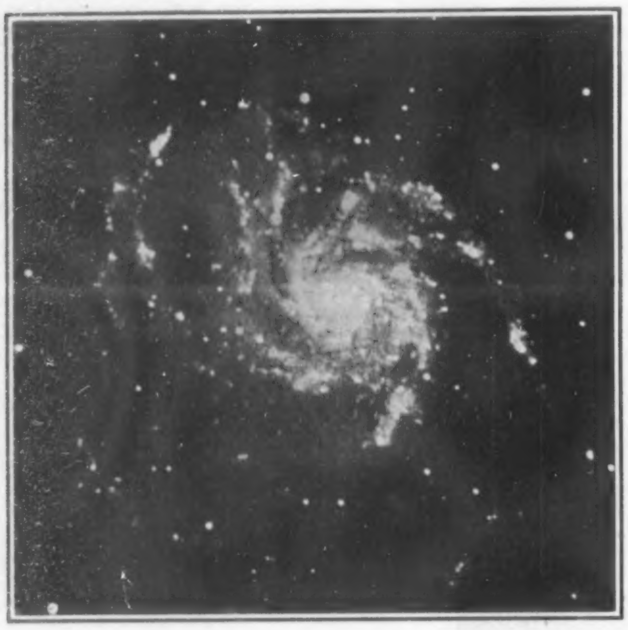
Everyone knows that the white light of the sun is in reality composed of many hues, some gay and others dull. By means of glass prisms or by means of diffraction gratings the sun's white glare is separated into its constituent colors and lines. Each color or each group of colors and lines is the chromatic sign manual of an incandescent chemical element. A grain of common table salt (sodium chloride) heated to incandescence in the blue flame of a Bunsen burner exhibits a spectrum in which a yellow tint is the predominant feature. That yellow tint is characteristic of the metal sodium; it always appears in the same place when seen in the spectroscope. The same yellow gleam appears in the spectrum of many stars in exactly the same position. Here we have convincing evidence that the metal sodium is contained in those stars. By means of the spectroscope the astrophysicist is enabled to determine not only the known elements of distant suns, but even elements as yet undiscovered on the earth.

Thus the spectroscope serves to bridge chasms that may measure myriads of miles, and enables us to analyze stars almost with the same nicety as we analyze earthly compounds in our laboratories.

Spectroscopic examination of the heavens has justified the supposition that the various stages which the fiery mist undergoes in the process of star-making may still be detected. Just as the paleontologist has succeeded in tracing the descent of the modern one-toed horse from a prehistoric five-toed ancestor by the discovery of fossil equine skeletons imbedded in the earth for ages, so has it become possible for the modern astrophysicist to study what may be called the

fossils of the heavens. He has thus succeeded in divining, with marvelous accuracy, the probable career of a planet, such as our earth, from the day when the first sphere congealed from the original glowing nebulous mass.

He has succeeded, for instance, in demonstrating that a body which has just condensed from the original mist, has a spectrum that differs widely from that of a star millions of years older; and further, he has succeeded in proving that the older sphere is spectroscopically quite different from an orb still more aged. The color or groups of colors and lines which constitute the spectroscopic picture of a star can be arranged in a chronological series quite as orderly as the equine skeletons that have preceded the modern one-toed horse.



The Spiral Nebula in Ursa Major.

Only within recent years have spiral nebulæ been discovered in sufficient numbers to be regarded as type-objects of the heavens.

Thus it has been deduced that the stuff of which stars were originally made, in other words the glowing mist, are those fire-like masses which astronomers call nebulæ—masses which will eventually be condensed into a planet. Indeed, so far has congelation progressed in some cases, that certain nebulæ are even called "planetary nebulæ." We find in the constellation of Orion a planetary nebula that bears unmistakable evidence of the process of condensation which it is undergoing. Within Orion may be seen a dazzling spot, composed in reality of four stars, all of them suns probably as large as the center of our solar system, perhaps larger. That these four suns constitute a system of their own, can hardly be questioned. Undoubtedly they were formed by the draining of the primeval mist about them, if we may judge by the surrounding empty blackness. Spectroscopically considered, this nebula of Orion is nothing but a gigantic mass of glowing hydrogen, nitrogen, and an unknown gas, in which gaseous mixture stars are plunged. That the four stars to which we have referred formed part of the nebula at some remote period, is evidenced by the fact that their gaseous composition is exactly similar to that of the uncondensed nebula about them.

This wonderful use which has been made of the spectroscope, we owe to the brilliant work of Sir William and Lady Huggins. Before they began their epoch-making investigations, astronomers supposed that nebulæ were merely clusters of stars so closely packed together that even the most powerful telescope could not disintegrate them. This supposition had for its basis the circumstance that many a star cluster which to the naked eye appears but a blur of light in a black sky, is seen through the telescope as a multitude of white points. The spectroscope has definitely settled, however, which aggregations may be considered nebulæ and which stars, and has revealed cosmic secrets that the astronomer of half a century ago despaired of fathoming. The composition of a star cluster is as different from the composition of a nebula as water from steel.

Curiously enough, the forms of nebulæ are almost as variegated as those of plants and animals. Sometimes a nebula may assume a comet-like form, of which the nebula in Andromeda is a striking example; sometimes it may be a mere wisp of light reaching for millions of miles across the sky, as the nebula in the constellation of Cygnus in the Milky Way. Sometimes it may be ring-shaped and filled with milky light, and sometimes it may assume the form of a spiral, such as the nebulæ in Canes Venatici and in the Triangle. Latterly it has been thought that perhaps in this spiral formation we see one of the very early stages in the life of a star.

The spectroscope is not merely empowered to separate the light of a star into its constituent groups of lines; it also tells us how far condensation has progressed and how far a star has developed. The temperature of the orb is recorded in the intensity of the lines; the pressure to which it is subjected by the width and sharpness of the lines.

As it ages, a star spectrum changes. So does its color. Red-hot metal is not nearly so hot as white-hot metal. The metallurgist, by observing the colors of molten metal, is able to determine its approximate temperature; similarly, the astrophysicist gages the temperature and the age of a star by its color. The spectroscope, therefore, tells a modern astronomer not merely what may be the composition of a star, but also gives him some inkling of its temperature and pressure, and therefore of its age. Thus, it has been surmised that stars which are of an intensely bluish white color, resembling that of an electric arc, must be comparatively young, because they must represent a stage immediately following that of nebulæ condensation. After the bluish white stage come the yellow,

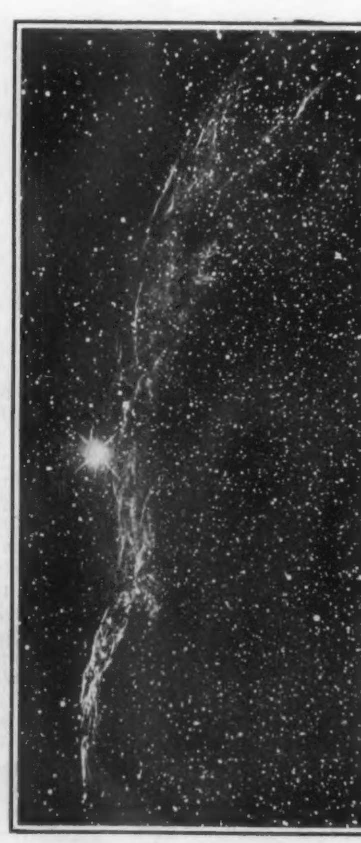
The Spiral Nebula in Canes Venatici.

It is surmised that this is one of the first stages in the creation of a star.

orange and red stages. Up to the yellow period the star grows hotter as it contracts, after which it gradually cools. These changes of color are accompanied by changes in the spectrum as well—changes which indicate a modification in the physical structure. We find that the younger stars are composed very largely of hydrogen. As the star ages, the lines of the gases diminish and those of the metals increase in number and intensity.

From all that we can gather from a spectroscopic study of stars, it would seem that our sun may be regarded as the hottest type of star. After the star has passed the stage reached by our sun, the metals increase in number; next comes the red stage, when carbon is particularly prominent in its spectrum. For ages after the red stage, the star still continues to shine, but eventually, however, it degenerates into an enormous black cinder rushing through space. The next stages are represented by the planets of our solar system and by our own earth. The most pitiful period we find in our moon—frozen, desolate, arid.

The Great Nebula in Andromeda, Characterized by Its Comet-like Appearance and by Its Pronounced Nucleus Formed Probably at the Expense of the Surrounding Nebulous Mass.



For Millions of Miles a Nebulous Wisp of Light Extends Into Space in the Constellation of Cygnus.

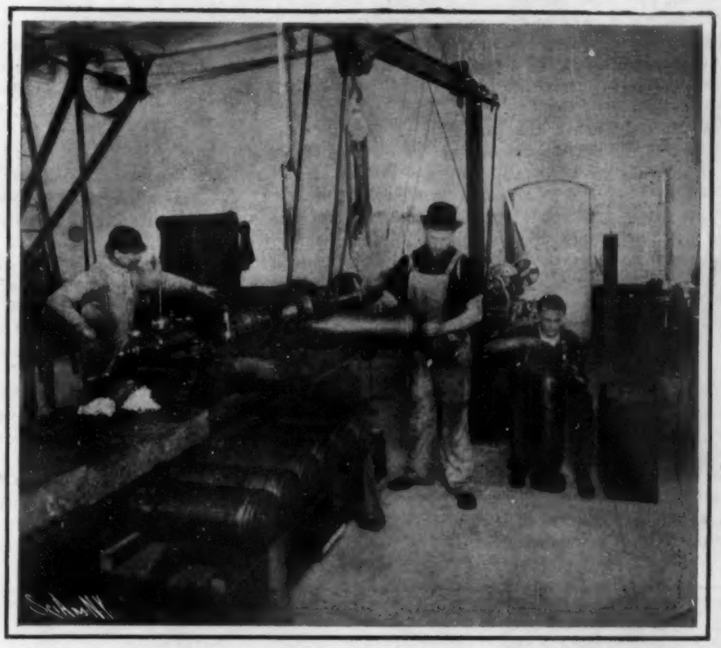
THE CREATION OF A STAR.

Some years ago the United States Weather Bureau rerated their anemometers, and, disregarding the Smeaton rule for determining pressures, worked out a new formula. According to this, the true velocity for an indicated velocity of 80 miles is 62.2 miles, and the corresponding pressure is 15.5 pounds per square foot. Other velocities and pressures are in the same ratio.

THE IONA NAVAL MAGAZINE.—I.

BY WALTER L. BEASLEY.

One of the most important ordnance centers of the government is undoubtedly the great naval magazine and ammunition plant at Iona Island, N. Y., some forty miles up the Hudson. Here, as the chief naval equipment base for the Atlantic coast, all the battleships are furnished with their thousands of shells and bags of smokeless powder charges. Through the courtesy of Admiral Coghlan and Commander M. L. Wood, the commandant at Iona, the writer was tendered exceptional privileges for obtaining data and a series of typical photos for the pages of the SCIENTIFIC AMERICAN, showing the comparatively little-known method of the preparation and manipulation of ammunition. The reservation covers 116 acres, and was purchased by the government in 1900 for $160,000. The place, which was formerly used as an excursion and picnic resort, and the grounds, from a wild, rocky, and neglected condition, by skillful engineering work carried out mainly under the direction of Chief Gunner A. T. Whitney, U. S. N., has been all regraded and leveled, and it now contains dozens of imposing edifices consisting of magazines, shell houses, a large power house, a handsome stone administration building and dwelling for the commandant, railroads, electric, compressed air, and telephone plants, waterworks, a fire system and a magnetic clock watch service. Commander Wood has introduced several new equipment features, notable among these being a modern telephone system with underground conduits and fifty-five stations, and the employment of compressed-air locomotives for hauling material to and fro. About one million dollars has been expended in perfecting and equipping the Iona magazine. Nearly 125 men are employed in the various departments; these are paid from $2 to $4 per day and they are a corps of unusually careful and skillful workmen. The vast quantity of war material and ordnance supplies, about three million pounds of smokeless powder and over one million of black, together with many thousands of shells, are housed in six brick and stone powder magazines 150 by 50 feet, four shell houses 200 by 50, two fixed ammunition houses, and two general storehouses. The powder magazines all have four separate fireproof walls and compartments in order to prevent a conflagration or explosion from reaching or destroying the entire contents. The power house is 160 feet long, and contains the compressed-air engine, electric generators, telephone central station, and ordnance machine shop. In the latter the copper-plate gas checks, one-fourth inch thick, for the base of the shells are put on. These have been recently adopted, and are intended to prevent premature explosion of the projectile in the gun from the interior gases. They are fitted in a groove turned in the base of the shell over a thin lead plate. There is an adequate water supply for fire fighting, the pressure being over 60 pounds per square inch. There are ten fire alarm stations, and fire drills are held every Saturday afternoon. A water standpipe, 80 feet high by 20 in diameter, with a capacity of 188,000 gallons, is filled from a reservoir on the west side of the reservation. The reservoir is a natural depression in the rock, walled in, and it holds about 250,000 gallons. The supply of water comes from surface seepage and springs. A system of roof drainage from the principal buildings has been arranged to flow into this reservoir, thus reinforcing the original supply. An artesian well over 100 feet deep furnishes water for drinking and domestic use.

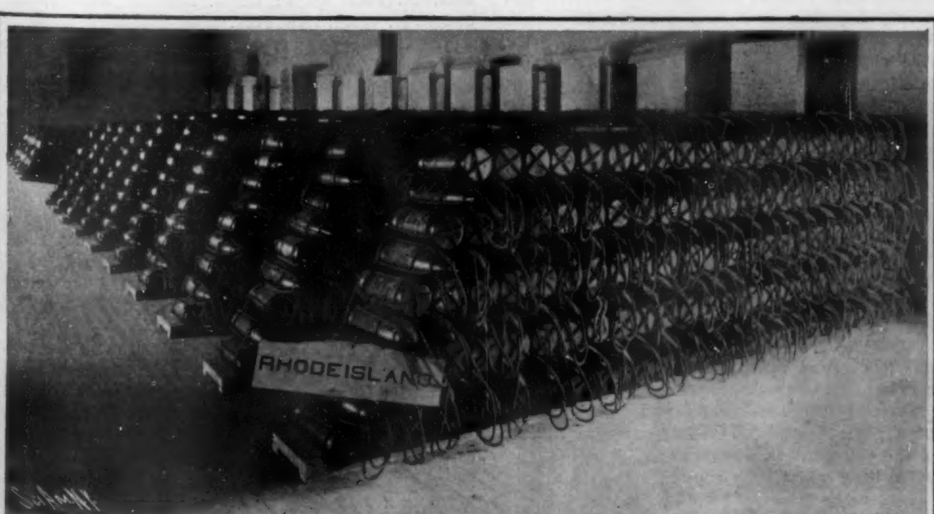


Turning Groove in the Shell for the Copper Gas-Check in the Machine Shop Power House.

Owing to the rapid increase of the navy, the station is taxed to its capacity to keep abreast with the demand to furnish new war vessels and old ones with their quota of ammunition. Just now the recently returned North Atlantic fleet, which exhausted its allotted ammunition in target practice, has been supplied with new shells and powder charges. To be prepared for any emergency, each ship is required, on returning to the navy yard, to restock as soon as possible her empty magazines. Also, in many instances the powder charges have to be altered. Then the bags are sent up to Iona Island, opened again, and the powder reweighed, diminished, or increased. For this work the ordnance tugs, "Apache" and "Pontiac," go alongside the vessels and take off the hundreds or more cans of powder to be changed, and also take on new unloaded shells from the Brooklyn navy yard. These are packed on lighters flying a red flag, and towed up to Iona Island. On reaching the landing the material is transferred to railroad cars on the wharf and taken to one of the storehouses or magazines. The train is pulled by a little sparkless, compressed-air locomotive. The engineer, when he wants more power, steps down from his cab at three different points, and connects the storage tank with an air pipe running from the power house. Seven hundred pounds pressure is taken on, which is allowed to run down to 50 pounds before recharging. These compressed-air locomotives cost in the neighborhood of $5,000, and two are in use at present. The several miles of railroad are so arranged that all the magazines, shell houses, filling and store houses are reached and unloaded at the doors on wide platforms. Just how many shells Uncle Sam's crack fighters have stored down out of sight is not generally known, nor the cost of these death-dealing missiles. The huge 13-inch, weighing over 1,000 pounds, with a 220-pound powder charge, comes to nearly $500, while the 12-inch, with 126 pounds for a powder charge, amounts to over $300. The capped, armor-piercing shells cost considerably more than the common shell. Here is a pretty close estimate of the number of shells the new battleships and cruisers are to carry, such as the

Exterior of Powder Magazine. Compressed-Air Engine and Car Taking Out a Load of Powder.

The Compressed-Air Engine for Handling Cars Loaded with Ammunition.



Interior of Shell House, Showing Pile of Loaded Shells for U. S. S. "Rhode Island" Incased in Rope Slings Ready to be Loaded on Board.

A Load of Powder Cans.

THE IONA NAVAL MAGAZINE.—I.

"Rhode Island," "New Jersey," "Georgia," "Connecticut," and "Louisiana": 96 12-inch, armor-piercing shell; 144 12-inch, common shell; 700 8-inch, common shell; 300 8-inch, A. P. shell; 1,680 6-inch, common shell; 720 6-inch, A. P. shell; 3,600 3-inch, R. F. cartridges; 2,400 1-pounder cartridges, and 300 field-gun cartridges. The "Connecticut" and "Louisiana" carry about 1,500 A. P. and common shells for their new 7-inch guns. The loaded shells are kept separated from the empty ones and are stored in the two fixed ammunition magazines. A piled-up section of the "Rhode Island's" 6-inch loaded shells is here shown in one of the accompanying photographs. Each shell is put on a pair of scales and weighed and numbered. The weight is recorded in chalk on the shell. The shell houses are of special fireproof construction. Magazine attendants, having their living quarters on the ground, inspect these as well as the powder magazines many times during the day and night. At night each visit is recorded on the disk of the magnetic clock in the administration building. The temperature in the shell houses and powder magazines is kept at 85 and 90 deg. The temperature readings are taken at regular stated intervals. Flood cocks with automatic revolving sprinklers for drenching the loaded shells have been installed in the shell houses. By opening these from outside the buildings the contents can be wetted thoroughly.

(*To be continued.*)

One of the Outdoor Telephone Stations Near Powder-Filling House.

Making the Powder Bags in the Brooklyn Navy Yard. In the Foreground Are 6-Inch Bags for 6-Inch Shells.

THE IONA NAVAL MAGAZINE.—I.

Some Facts About Mushrooms.

BY ARTHUR H. J. KEANE.

A problem which has occupied the minds of agricultural and scientific men for many centuries past is how to cultivate mushrooms with as much ease and success as potatoes, carrots, turnips, and parsnips. The solution of this problem has so far proved extremely elusive but, within the last ten years, researches in this direction have taken a fresh turn which (in all probability) will hasten the advent of some means whereby it will become possible to increase and vary the production of a vegetable which, though of delicate flavor and nutritive excellence, is at present a luxury for the public at large. So far the *Agaricus campestris* is the only member of the mushroom family which has lent itself to experimental cultivation, all other edible varieties (including the truffle) remaining obdurate to all scientific attempts at cultivation; undoubtedly their production has been fomented in certain districts, but this is due merely to very empiric methods. The mushroom sold in our markets has also not much progress to boast of, as it is still grown precisely in the same way as it was over a hundred years ago and more; the only difference is that it is now grown in larger quantities, while means have also been discovered of protecting it from certain diseases to which it is liable.

Every plant in the vegetable kingdom, as a rule, springs from and produces seed. Mushrooms, toadstools, and other fungi are no exception, but their reproductive bodies are termed spores. Though these latter are truly analogous to seed, still they differ from it in structure.

Spores, for general purposes, may be regarded as reproductive bodies without an embryo, this latter being the minute rudimentary plant invariably found within true seeds. The spores of some fungi are so inconceivably minute that it would require more than two hundred million placed side by side to cover one square inch; yet these atoms keep constant to particular patterns, both in shape, size, and color. Each of these atoms is endowed with a sparklet of life which, under favorable circumstances, will cause the minute spore to swell, burst and reproduce the parent plant from which it sprang. The spores of different species of the mushroom family vary greatly in size, shape, color and quality. Some are one hundred times larger than others, and they take all sorts of geometrical and ornamental forms; many are white, some blue, green, red, yellow, or black; and, while some are perfectly harmless others are violently poisonous in their effects. The purple brown or violet spored edible mushroom so common in our fields consists, as our readers are aware, of an umbrella-shaped top carried by a cylindrical and vertical stem. On the lower surface of the "cap" (as the top is technically termed) there are thin blades or strip-like lengths of violet color which radiate all round the point of union with the stem; on cutting through one of these blades or "gills" and examining it with a microscope it will be seen that small oval bodies of a dark purple color spring therefrom and are attached two by two to thin filaments or threads. Each of these small oval bodies is a spore, and it is they in their entirety which impart the violet hue to the lower part of the cap. If a sheet of white paper be placed beneath the cap of a ripe mushroom, it will, after a short space of time, be tinted violet by the impalpable powder falling upon it. Each single one of these microscopic spores, provided it meet with the requisite favorable conditions, will thrive and produce a network of white filaments from which a new vegetable growth will originate that in due course, and for several years in succession, will produce growths similar to those to which the spore first owed its being. This is a brief and simple explanation of what scientists term cryptogamic generation. The filaments thus formed by the germination of the spores form in their entirety what is called the "mycelium," which forms the actual vegetative part of the mushroom, and is to it what the root is to superior orders (phanerogamæ) of plants. This mycelium ramifies indefinitely, and combines to form small whitish balls or globules; these latter gradually grow and increase in volume till they form the perfect mushroom. While pursuing its course underground (and before the small white globules forming the future mushroom appear on the surface), the mycelium is nourished at the expense of all other plants, which it destroys, at the same time sterilizing the soil, and exhausting all the potassium and phosphoric acid; however, it carries with it in its circular course various nutritive principles, the result being that a dark circle is formed on the grass, which shows up in marked contrast to the withered and yellow or poorly nourished verdure in the immediate vicinity. These marks have for many years past been the object of romance in all countries where children love to feast their minds upon witchcraft and goblin lore. These circles of grass, greener and more luxurious in growth than that surrounding them, are supposed by children and simple-minded country people to be "fairies' rings" left by the marks of fairy feet, after long and frisky frolics and dances in the silvery moonlight. Poetry must again give place to prose. We have no fairy feet to deal with, but merely the work of the spores of the little fungus called the "oread" or "fairy ring *champignon*" (*Marasmius oreades*) one of the best of edible fungi; it is of a creamy yellow color throughout; its blades (gills, as they are technically termed) are broad and each distinct; its stem is slender and solid, and it is possessed of a strong aromatic scent. It may here be pointed out that the stem of this mushroom is quite naked, while that of a noxious relative (and frequent neighbor), termed the "stinger," is downy at the base. In due course the little white balls appear in the circle, and gradually develop into the toothsome mushroom.

Mushrooms are cultivated everywhere. They grow in many strange places—among others in the Catacombs at Paris. The most likely place wherein to find mushrooms growing is a meadow or plot of grass, but they are also often met with in woods, on heaths, and in unfrequented wayside nooks. Of late a curious field for their growth has been selected in France. The St. Denis (department of the Seine) railway tunnel is no longer used for the purpose for which it was originally intended. It has been acquired for other purposes, and the ground therein has been cut up into ridges, divided from each other by means of furrows, upon which whole battalions of mushrooms are now flourishing in the shade of the gloomy tunnel walls. This enterprise (which is amply repaying all the time and capital expended upon it) has its counterpart in Scotland, where a company is now growing this class of vegetable in a tunnel 3,000 feet long. It was originally built by the North British Railway Company, and is 60 feet below the streets of Edinburgh.

Besides being a palatable morsel, the mushroom may also be termed the athlete of the vegetable kingdom. About a year ago some asphalt paving was laid down in a continental town, imprisoning some spores of a variety of the mushroom known as the *Champignon psalliota campestris*. In the course of their germination these spores lifted the asphalt, and finally split it in half in their struggle to reach light and life. Doubtless the asphalt may have been softened to a certain extent by the warmth engendered by the growth of the spores; still, in any case, Prof. Buillemin, of Nancy (France), estimates that the pressure exerted against the asphalt by the champignon must have amounted to about 25 pounds.

An Effective Mail-Bag Catcher Wanted.

An opportunity is now presented to inventors familiar with railway appliances to devise a mail-bag catching and delivering apparatus for fast-moving trains, by which mail bags can be caught and transferred to the car, and at the same time delivered safely from the car to a designated locality without mutilation. It appears the dropping or throwing of mail bags from a moving train, especially at night, is uncertain to occur at the right time, and occasionally mail bags are lost. Second Assistant Postmaster-General Shallenbergh at Washington has ordered an investigation into appliances of this character, for the purpose of selecting a type that is certain to be more effective than the present apparatus.

A commission has been appointed to make tests, composed of C. W. Vickery, superintendent of Railway Mail Service; John Holliday, chief clerk of the Post Office Department, and B. L. Andrus, superintendent of equipment, all of Washington, D. C.; Charles Rager, Railway Mail Service, Cincinnati, Ohio; Norman Perkins, St. Paul, Minn.; H. M. Robbins, Atlanta, Ga., and H. M. Wade, New York.

Inventors may communicate with any of them The Second Assistant Postmaster-General states that more than one hundred inventions in the shape of arms to remove mail bags from fast-moving trains have been presented to the Post Office Department within the past four years. Some of them seem worthy of investigation.

The commission will inspect inventions all over the country, and will report and make recommendations to him. It is believed some of the inventions may prove to be efficient in the handling of the bags.

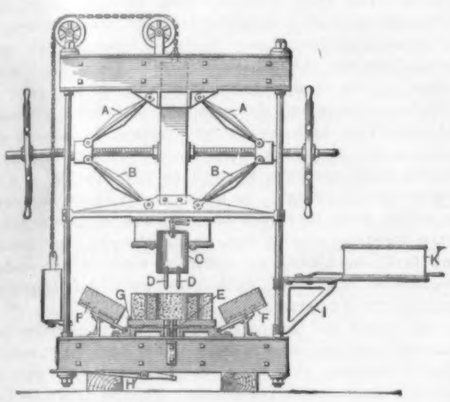
Inventors should thoroughly test their inventions before submission to the commission.

According to reports made at the office of the American Motor Car Manufacturers' Association, there were 91 cars imported during the month of July, at a total valuation of $345,774. This is a decrease from July, 1905, when 101 cars were imported. There were 701 cars imported during the first seven months of the year. On the other hand, exports for July were double those for 1905, showing that the American motor-car industry is reaching out for the world's trade. There were 266 cars exported, of a total valuation of $485,672. During the first seven months of the year, the exports amounted to $2,829,289.

Patent Department

CONCRETE BLOCKS MADE BY POWER.

A power concrete-block machine has recently been invented by a Western architect, Mr. Wallace L. Dow, and introduced by the Perfection Block Machine Company, of Minneapolis, Minn., which does what has never before been accomplished in the manufacture of concrete blocks. Heretofore in making blocks under pressure, it was impossible to drive out the compressed air, with the result that the blocks were defective. This objection is entirely and simply overcome by Mr. Dow in his machine, so that compressed blocks can now be made as dense within as they are without, free from all voids. The machine in question measures the material accurately, forces it down into a mold under such heavy pressure that all voids are completely filled, and produces blocks which are absolutely uniform in density, strength, and durability. Still more remarkable, it produces from sixty to one hundred blocks an hour with five to eight unskilled laborers at one-half the cost of the usual method. Each block is subjected to a pressure of over one hundred tons. Hence this power machine requires about ten per cent more material than is ordinarily needed, therefore producing a more compact block.



SECTIONAL VIEW OF THE PRESS.

Of the saving in time effected by such a machine, it may be said that 6,000 blocks can be made in ten days. At least sixty days would be required to make the same number by hand on a single machine. In the same time, the power machine would save about $200 in labor. Moreover, the cost of making the largest block is no greater than the cost of making the smallest.

A test conducted at the University of Minnesota by Prof. William H. Kavanagh showed that a plain block made on Mr. Dow's machine cracked at 163,660 pounds and was crushed at 167,200 pounds pressure. Two bevel-face blocks were also tested but gave no signs of cracking or failure, although the testing machine registered its maximum pressure of 200,000 pounds. A rock-face block was cracked and crushed at 97,760 pounds. This last block was imperfect, and would have withstood probably an even more formidable test had it not been broken in shipment to the laboratory.

Broadly considered, the press comprises a bed and a reciprocating head, supported and guided by strain-rods. Toggles *A* and *B* threaded on a power shaft serve to raise and lower the head. The striking features of the press, however, are to be found in the arrangement of the mold.

The mold is provided with laterally-swinging sides and downwardly-swinging ends *F*, the sides and ends being so grooved and tongued that when they are thrown inwardly and closed, ready to form a block, they are firmly locked together so as to withstand the enormous pressures to which they are subjected when the head descends. The mold bottom *G* is formed by a plank which rests on the mold bed. It extends out over the sides and ends of the mold, which are carried by their hinges high enough to close in above and not around the wooden mold bottom. The mold bottom is designed to serve as a platen for lifting out and carrying the molded block while it is being dried, and a sufficient number of planks are provided to keep the machine in service. The mold ends *F* carry the core pieces which form half-cavities, and which can be removed to make solid end blocks in the ends of the blocks. The central entire cavity is produced by a core *C*, upwardly removable from the mold, which core is provided with tenons *D* passing through apertures in the mold bottom and serving to hold the core rigidly in its proper position during the formation of a block. A thrust-bar *E* operated by a foot lever *H* loosens the core from the block after compression.

Compression is effected by a follower operated by the toggles and screw mechanism previously mentioned. After the attendant of the machine has thrust up the core of the machine by the pedal-lever, the core is automatically latched to the follower, and withdrawn upwardly from the block with the rising follower. The attendant then swings the ends and sides of the mold away from the block, and two laborers carry it away on the plank which constitutes the mold bottom. By the time they have returned, the machine attendant has placed a new plank in position, unhooked the core from the follower, placed it in position, and closed the sides and ends of the mold, ready for a new charge of sand and cement. Power is cut off automatically at the up-and-down movement, so that the blocks are all of uniform thickness. The height of the block can be adjusted by raising or lowering the top beam of the press.

The charge is carefully measured, in order to produce blocks of uniform density. A measuring or filling box *K* is provided, which is carried by a swinging arm *I* mounted on one of the posts of the machine. This filling box is provided with a sliding bottom, and is designed to be located near the sand and cement mixer, so that it can be conveniently filled. The box is adjustable in height to obtain the right amount of material for different-sized blocks. In charging the mold, the filled box is swung into proper position and the bottom pulled out, the sand and cement falling into the mold around the central core. In order to increase the efficiency of the press, it may be operated in connection with a mixing machine by which the sand, cement, and water are mingled in the proper proportions. The mixing machine and the press are driven by the same 8-horse-power engine.

To the various kinds of blocks that can be made on this machine there is practically no limit. Corner blocks are made for each width in plain, pointed, paneled, tooled, and rock faces. Fractional blocks are made by mounting knives on the mold sides. These knives cut to a depth of 1½ inches, leaving a solid web, so that the blocks can be kept in one piece for curing. When the block (or rather the fractional block) is ready to be laid in the wall, a slight blow will break the web. Knives fastened to the end cores cut the blocks lengthwise in the same manner, and produce fractional blocks which can be used as facing blocks on the end of a first tier or as fillers between joists and between spaces for making walls over twelve inches in thickness. The blocks made are rabbeted on the inside corners to leave a ¾-inch space, which is to be filled with mortar so as to form an absolutely tight end joint, a feat which cannot be performed with the usual type of blocks. The machine is provided with adjustable bay-window molds with angles varying from 30 to 60 degrees; the bay-window blocks can be made in all faces on either inside or outside angles.

CONCRETE-BLOCK POWER MACHINE CONNECTED WITH A BATCH MIXER.

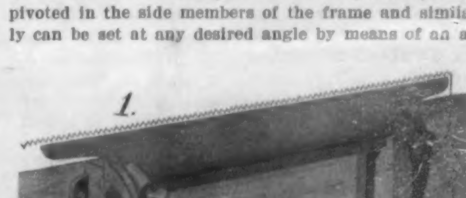
RAILWAY SIGNALING DEVICE.

The frequency of railroad accidents occurring in the very face of warning lights or flags emphasizes the inadequacy of mere visual signals for so important an office as the safeguarding of human life. Many inventors realizing this deficiency of the ordinary signaling system, have devised various auxiliary signals designed to assist in attracting the engineer's attention. One of the simplest of these is illustrated in the accompanying engraving, and it consists in means for automatically sounding a gong in the car or the engine cab, which will warn the motorman or engineer of danger in case he has disregarded the primary signal. Our illustrations show the system as applied to an electric car line, though it will be evident that it could be used equally as well on a steam railway line. The usual semaphores are employed for the primary signals, but contrary to the common practice the semaphore arm extends over the track in such position as to trip a lever carried by the car. As illustrated in the small detail view, when the semaphore arm *A* strikes the lever *B* it acts to sound the gong *C* within the car, thus notifying the motorman that he has passed a danger signal. This gong signal, it will be understood, is not meant to take the place of the primary signal, but serves merely as a precautionary device to prevent total disregard of the signals. In many respects an aural signal is better than a visual one, because it attracts attention even when the motorman's or engineer's attention is momentarily distracted, while tending to the mechanism. One of the principal advantages of this system is its extreme simplicity, and the fact that it may be readily installed by reversing the position of the regular semaphore arms. A patent on this signal has recently been procured by Mr. Michael McGowan, of Togus, Me.

RAILWAY SIGNAL DEVICE.

AN IMPROVED SAW-SET.

Pictured in the accompanying engraving is an improved saw-set invented by Mr. Harry W. West, of 5 Penwell Street, Victoria, B. C., Canada. This device is so arranged as to give any desired set to the teeth, and it also comprises a vise in which the blades may be securely held while the teeth are being sharpened. The saw-set consists primarily of a frame, which may be secured to a work bench. A heavy cross bar at the upper end of the frame serves as an anvil, against which the teeth may be set. For this purpose the face of the bar is beveled, as best shown in the section view, Fig. 3. Above the anvil are a pair of jaws adapted to clamp the saw blade. The inner jaw is pivoted at opposite ends in the frame, and may be adjusted to any desired angle from the vertical by means of a set-screw. The other jaw is also adjustable, being pivoted in the side members of the frame and similarly can be set at any desired angle by means of an ad-



AN IMPROVED SAW-SET.

justment screw. Fig. 1 shows by dotted lines the position of the saw-blade when the teeth are to be sharpened. It will be noted that these teeth project slightly above the clamping jaws in convenient position to be filed. In Fig. 2 we show the position of the blade when the teeth are to be set. It will be noted that the blade is clamped with the teeth resting against the face of the anvil. A rod extends across the frame below the anvil, and mounted on this is a punch which may be swung up against the saw teeth. In operation the punch is struck with a hammer so as to force the alternate teeth of the saw against the anvil, this being permitted owing to the fact that the punch has free lateral movement along the rod on which it is mounted. After the alternate teeth have all been set, the blade is removed and replaced in the vise with its opposite face against the anvil. Thereupon the intermediate teeth are set by means of the punch. By means of the set-screws the jaws may be adjusted to any desired angle with respect to the anvil face, in order to give the saw-teeth the desired set.

STREET CLEANER'S TRUCK.

A very useful improvement in street cleaners' trucks has recently been invented by Messrs. John Rehm and Theodor von Gerichten, of 570 East 149th Street, New York city, N. Y. The principal advantage of the apparatus is that it provides means for conveniently raising and dumping the refuse of the street into the can or receptacle. Furthermore, the receptacle can be readily removed or replaced on the truck, when desired. The apparatus comprises a frame supported on two large wheels and a trailer wheel. At the upper end of the frame are a pair of oppositely-disposed brackets, one of which is indicated at *A* in the engraving. These brackets are formed with sockets adapted to receive the trunnions of the can. Pivoted at *C* on these brackets is a yoke lever, whose lower arms support a dumping pan. The upper arms of this lever form an acute angle with the lower arms, and serve as a handle for the truck. The engraving shows the can resting on the ground in position to receive the street sweepings. The street cleaner can dispense with the usual scoop, and sweep the refuse directly into the pan. This done, the handle is swung over the can to the position indicated by dotted lines. The pan will thereby be raised and its contents dumped into the receptacle. Indicated at *B* is one of a pair of grapples mounted at opposite sides on the frame, and which are adapted to engage and hold the handle so that they can be used for moving the truck to any desired position. The grapples are hinged to the frame so that they can be moved out of the way of the handle when desired. Below the grapples *B* are a pair of hooks *D*, which are adapted to hold the handle in a more depressed position. When engaged by these hooks the handle may be lifted up, carrying the frame with it, swinging the brackets *A* over the axle of the wheel and down the other side, and thus depositing the can on the ground. The can may be readily replaced on the truck by reversing this operation.

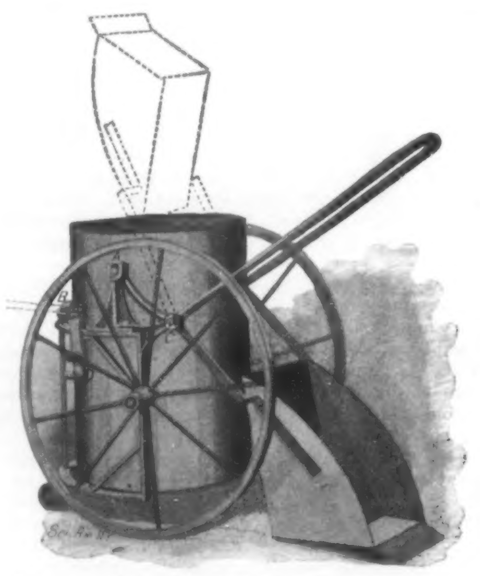
A NOVEL CIGAR LIGHTER.

The common alcohol-burning cigar lighter in which detachable torches are provided is a very convenient device, particularly in a busy store. However, it has the disadvantage that a flame for igniting the torches must be kept constantly burning, thus occasioning a waste of fuel when the device is not in use. Electrical cigar lighters on the other hand use no current except when it is automatically turned on to light a cigar. But they usually possess the disadvantage of being rather cumbrous to handle, as the entire device must be lifted to the cigar, and furthermore the wire connections limit the area over which they can be moved. We illustrate herewith an improved cigar lighter, which aims to combine the advantages of both the torch and the electric lighter. The device comprises a stand with a pair of branching arms in which the torches are placed. At the top is a receptacle for tooth picks or the like. Within the device is a well for oil or other inflammable fluid, and connected with this well are a pair of wicks, which conduct the fluid to the torch receptacles. The torches are provided at their lower ends with absorbent material adapted to soak up a portion of the oil furnished by the wicks. In place of an oil flame for igniting the torches an electrical sparking device is used, consisting of a small spark coil within the stand and a battery for actuating the same, the terminals of this coil being connected to a series of sparking fingers which project through the wall of the stand into a slideway. In use a torch is taken from its receptacle and drawn down the slideway, whereupon a series of sparks will result, due to the contacting of the fingers, and the inflammable material in the torches will be ignited. The cigar may then be lighted, and the torch returned to the receptacle. It will be noted that there is no waste of current, as there is no flow except when the torch is drawn down the slideway. At the same time the cigar lighter possesses all the advantages of the usual alcohol-burning type. A patent on this device has been granted to Mr. George S. Andrews, of 147 North Main Street, Butler, Pa.

Profitable Mechanical Invention.—I.

BY THALEON BLAKE, C.E.

Travelers assure us that even in those remote parts of the world where the name America is but a report, and consequently where a classification of national characteristics is based on no more secure foundation than mere hearsay, each of us is reputed to possess fabulous wealth and marvelous mechanical skill.



STREET CLEANER'S TRUCK.

The false note of exaggeration in this prevalent assumption is manifest; yet there is a pronounced sound of truth in it.

Each of us is at least rich in that inheritance bequeathed by our mechanicians. Besides, the American inventors have made wealth possible to untold thousands of their countrymen, by creating labor- and time-saving machines. Liberal patent laws have stimulated Yankee ingenuity; many have become inventors solely for the remuneration of wealth or fame, and have surpassed expectation.

And the field of invention is not yet worked out. Prizes still await the patient and, above all, the observing men. Yet there has been a great change in the personnel of inventors within the last quarter of a century.

This change has largely been brought about by the mechanical engineers, who follow inventing as a profession. For these men go about their life's work with well-defined plans and aims. Like careful explorers, they select some particular region to explore, and then proceed to explore it systematically. If

A NOVEL CIGAR LIGHTER.

some of them fail of the highest achievement, it is not because of insufficient preparation and of indefinite ideals. They know what they want before they set forth upon their expeditions. They do not end their march in the neighborhood of some North Pole of mechanics, arriving there accidentally, after a meandering march to and fro in some Torrid Zone, aimlessly seeking countries to explore. They have their North Pole in their mind's eye, and strike directly for it.

The result is that inventions are no longer so exclusively accidental, nor the result of inconstant thinking, and of chance experiment. Much of the haphazard progress of mechanics has been eliminated; much of the romance dispelled.

Still, any man may conceive an idea, and a valuable one. The professionals have no corner in ideas. That is impossible.

It is this element of chance which makes the inventing game so alluring to the novice. The fascination of possibly drawing a prize, of stumbling upon a fortune, conquers him. Should at any time an increasing proportion of unprofessional inventors be doomed to little or no returns from their experiments, it is to be ascribed to their having attempted to invent devices already perfected, or even long since antiquated. The fault will be theirs because of an unwise selection of a subject for their meditation and practical improvements. It is of these important truths, and for the benefit of bright young men who evince a love of mechanics, that this is written.

Before considering the prospects of being a successful temporary inventor, let us examine the aspects of professional inventing, and especially the manufacturer's point of view, as well as his relation to the professional inventor. In many of the large factories in which such machines as gas engines, typewriters, arms, bicycles, automobiles, standard farm implements and farm machinery, or electrical supplies are made, mechanical engineers work ceaselessly for improvement of their products.

"If I could get the public to buy new machinery as fast as I can get experts to design it and get it out, I should be very rich in a very short time," said a thriving manufacturer recently. That is true; for in quite a number of large industries, the expert mechanical engineers are far ahead of the actual demands of the trade. No sooner does the public fairly take up with a machine, than along comes a manufacturer with a superior one which his experts may have had perfected months before, and which he may have kept back, waiting for a fit time to introduce it.

Sometimes manufacturers have better models of machines than the ones they offer for sale; they may not be in any hurry to push out these improved machines, as they, perhaps, may have a great deal of money recently invested in the plants in which the older models are made. They may not desire a too hasty change to the better models, as it would necessitate a discarding of old methods of manufacture, sending of expensive tools to the scrap-pile, or dismantling of entire plants.

"But does it not pay to be progressive?" is a question apt to arise in the minds of students and experimenters.

To which query it may be said that all manufacturers of standard types of machinery are very conservative. However, new types will be placed on the markets of the world. Thus it occurs that frequently machines are abandoned before being worn out, because they are rendered obsolete by the incessant improvements of the professional inventors, who are thorough masters in their lines of endeavor and of the conditions and wants of their several markets.

The professional inventors as a body bear an intimate relation to the great industries, some of which would not have been created but for the brilliant work of these gentlemen. There is a growing respect and union between the manufacturers and the professional inventors, which results in profit to both sides, although it goes without saying that the former still gather the lion's share in the matter of dollars and cents.

Why is this so, that manufacturers entertain an unwonted respect for this new class of inventors? Because of the training of this class in mechanics, or in mathematics, or in chemistry, or in advanced shop practice and shop economics. Because, also, of their practical aims and successful solution of practical problems intrusted to them for scientific investigation or improvement.

A professional inventor to be successful in many inventions must have, first, an accurate knowledge of what machines are being built similar in design, or for a similar purpose, to his; and second, above all things, a prescient ingenuity, inasmuch as he must have a correct intuitive perception of how the trade, or the public, needs, and is likely to welcome, his contemplated inventions. Indeed such a man is in the possession of a high order of ability.

It has often been remarked that it is not nearly so difficult to invent, as to find out what to invent. It is, indeed, a veritable stroke of genius to catch a glimpse of an idea which is at once absolutely new and very valuable. But the highly-trained mechanical engineer goes one step farther. He realizes that it is more important to know what not to invent than what to invent, as many machines that are inventable are not also profitable. This is what the professional inventor, from his occupation and association, is especially competent to know.

Thus it will be seen that the amateur inventor has

two formidable competitors. Besides the professionals, there are the specialized workmen in the various industries. For instance, in a large automobile factory it is safe to assume that a respectable number of competent workmen are constantly evolving improvements. These men have a peculiar advantage, being on the spot where the latest types are made, and having most excellent opportunities of getting acquainted with the models of their company's rivals, as well as with the minutest details of the models which they make.

What chance, other than a gambler's chance, have unskilled inventors to compete with these two bodies of competitors? Very little chance, indeed, in a few lines of manufacture; but elsewhere, all the wide world in which to roam or to explore. But more of this later.

The first and chief handicap which offers an obstacle to the untrained inventor's success, lies not so much in his lack of brains or opportunity, as in his application of brains to abstract or even visionary projects. For example, if the brains which have been wasted on perpetual motion and on other delusions of like ilk, had been given to homely and every-day necessities, the mechanical achievements of the race would probably be noticeably in excess of what they are. And strange as it may sound in the ears of many people of education, the perpetual motion chimera is very much alive this very day. Men who are afflicted with that disorder of the judgment, usually maintain a rare secrecy about their experiments. This reticence is due partly to shame; for although they firmly believe the possibility of a machine being constructed which, once started, shall run until worn out, they very sensibly perceive the hostility of the public to that form of experiment; but this silence is also, and very likely, more instigated by the thought of the abnormal wealth which they conceive will inevitably be the reward of the inventor of a perpetual motion engine.

Nor are these men universally the cranks which a superficial reader may be induced to call them, as they are commonly very useful citizens, and in other respects practical and hard-headed to a degree. Yet by this delusion are they held in an iron obsession. Education is the foe which will drive delusion to cover, and here education may be hopefully sought, as much of mechanics may be self-taught. Many of these sorry day-dreamers, who are poor to-day, would have an excellent chance of being independent tomorrow, if they would but become awake to the real.

A patent attorney of large practice recently wrote, in a letter to a friend, that the bicycle, the rifle, the sewing machine, have been about abandoned by the amateur, who is at present more favorably impressed with the wealth-creating possibilities of the automobile and aeroplane. This is a humorous way of stating that amateurs would rather follow than lead, rather try to invent things about which they know little, than to try their talents where they really might succeed.

Mere industry backed by crude knowledge accomplishes barren results in mechanics, whereas original research in lines well understood is prolific of inventions of merit.

Another hindrance to achievement which impedes the man who does not engage in invention as a regular and gainful occupation—who, for instance, becomes a mechanic only for the purpose of developing an invention or two—is that he is frequently led astray from the inventing of simple articles to try for the solution of the most difficult and complicated mechanisms, which require, for proper solving, like intricate mathematical problems, a thorough training, much experience, and considerable time. Such a man soon feels discouraged as the tasks prove to be unconquerable without skill, money, and extensive shop facilities. To essay certain kinds of invention, a man must be peculiarly talented, or very rich, or probably both talented and rich; for machines, other than simple, often necessitate a model-making plant quite as extensive as an ordinary, fair-sized machine and foundry shop.

(To be continued.)

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

GARMENT-FITTING DEVICE.—ROXANNA A. HAMPTON, New York, N. Y. The device is more especially designed for enabling a dressmaker or other person to accurately and quickly determine the length of a skirt from the waistband down to the bottom edge and the distance the latter is from the floor, with a view to insure a proper hang of the skirt and to have the bottom edge thereof all around an even distance from the floor.

SIZE-REDUCING DEVICE FOR HATS.—R. H. CURTIS, Long Branch, and H. D. CURTIS, Red Bank, N. J. One purpose of the invention is to provide a device whereby the size of the hat, cap, or other article of headwear may be reduced at will from the normal size to any fraction of a size provided for by the construction of the device—a half-size for example. The interior of the hat at the brim may be reduced in size all around or only at the front, back, and sides, or at any desirable single or multiple points. The device is applicable to the crown of any hat.

CLASP.—DORA O. MCHUGH, Lorain, Ohio. The invention relates to clasps, and particularly those applicable to the securing of shoe-ties. Its principal objects are to provide a neat, convenient, and secure clasp for such purposes. It is symmetrical and inconspicuous and, if desired, may be made of more or less ornamental appearance and of precious metals.

Electrical Devices.

ELECTRIC SIGNAL FOR WEIGHING-SCALES.—S. J. DERBES, New Orleans, La. The invention refers more especially to electric alarm-signals for association with some part of a weighing scale or machine to be operated by the scale-beam for indicating to a salesman or attendant of a store or other establishment that goods being weighed on the scale are approaching the weight at which a balance will be established therebetween and the poise or the poises on the scale beam.

Of Interest to Farmers.

SEEDER AND PLANTER.—G. G. GILBERTSON, St. Ansgar, Iowa. The device is mounted upon wheels and is provided with handles projecting to the rear by which the machine is pushed along in front of the operator, its special purpose being to plant such small seeds as onion-seed, peas, and the like. It may in many of the features be applied to team-drawn seeders and be adapted for planting any kind of seed.

THRESHING-MACHINE.—D. STILL, Milton, Ore. Mr. Still's invention relates to threshing-machines; and the object is to provide an improved apparatus of this class which shall be efficient in separating the heads of grain from the straw and chaff. The invention concerns itself especially with the shoe and the manner of handling the threshed grain and subjecting the same to air-currents.

Of General Interest.

TICKET-BOX FOR THEATERS.—P. H. BREHMER, Rutland, Vt. One purpose here is to provide an arrangement of a box especially adapted for use in theaters and other amusement places, which box can be located in an opening in the wall adjacent to the ticket-window and which is constructed to contain all tickets to be offered for sale on a given date placed under designations of the various parts of the house to which the tickets afford access, the arrangement being visible to the purchaser but protected from him.

DRUM.—A. D. CONVERSE, Winchendon, Mass. The purpose of the improvement is to construct the drum entirely of sheet metal, so that the heads can be securely attached to the shell without any intermediate props or supports being employed, the sole supports for the heads being at the edges of the chimes of the shell and from uniform contact the inner face of the shell. It relates particularly to metal toy drums.

LOADING APPARATUS.—J. J. ROBINSON, Bloomsburg, Pa. The invention relates to the loading and unloading of trucks used for transporting goods. It is especially applicable in shops and mills for the purpose of facilitating the moving of loads of material in bulk. The object is to produce a construction of truck and platform for the load which will facilitate the moving of the load from the truck to the platform, or vice versa, and to transfer without breaking the bulk.

ATTACHMENT FOR HAND-OPERATED BRUSHES.—J. GRAF, Paterson, N. J. This invention relates more particularly to an attachment for hand-operated brushes of the kind used for spreading paint and varnish, the attachment being flexibly connected with the brush in such manner that the operator while using the brush may move the shield relatively to the same within certain limits.

ORE-SEPARATOR.—P. A. HARDWICK, Colorado City, Col. In this patentee's invention the improvement relates to apparatus for separating and securing the values of the ore, and the inventor has for his principal purpose the provision of an effective apparatus of this character. In use the lightness of the apparatus greatly facilitates its conveyance to the deposit to be operated upon.

FASTENER FOR EYEGLASSES.—D. W. KOLLE, Portland, Ore. In the present patent the improvement has reference to fasteners for eyeglasses or spectacles, and it is intended to be especially useful in connection with the construction of eyeglasses for making a simple connection between the lens, the bow or spring, and the nose-guard.

Heating and Lighting.

ACETYLENE-GAS GENERATOR.—T. S. HOLT, Federalsburg, Md. The invention relates to a generator of that class in which a quantity of calcium carbid is discharged into a mass of water, generating the gas, which is subsequently conducted to the gas-holder, the gas-holder being connected with devices by which the carbid supply is automatically regulated according to the amount of water in the holder.

Household Utilities.

DEVICE FOR ROASTING MEATS AND THE LIKE.—D. G. WALKER, Lindsay, Neb. The improvement relates to culinary vessels, and has reference more especially to devices for roasting meats and the like, being substantially of the type of device for similar purposes described in Mr. Walker's former patent. It is effective and reliable, simple in construction and practically self-controlling. The structure may be readily taken apart for cleaning or repair or other purpose and again put together.

IRONING-BOARD.—A. N. MARSDEN, Trenton, Mo. The improvement is particularly adapted for use in laundries, and the object is to rotatably mount on a center support or standard a plurality of boards of different sizes for convenience in ironing various articles, the boards being so mounted that the ones not in use may be swung downward out of the way.

Machines and Mechanical Devices.

WINDMILL.—F. M. ESPINOSA, New York, N. Y. The object of the inventor is to produce a mechanism of this kind which, having folding arms, may be extended at will and, further, to provide improved means for controlling the position of the vanes and governing the power developed by the mill.

MACHINE FOR FORMING PLASTIC MATERIAL INTO LUMPS.—C. BRISTOW, Christchurch, Canterbury, New Zealand. The machine forms butter and other plastic materials into lumps ready for table use, the machine being more especially designed for use in restaurants, hotels, and like establishments and arranged to permit an operator to quickly and conveniently form lumps of any desired shape in a very convenient and sanitary manner without much exertion.

HACKSAW-FRAME.—A. ADAMKIEWITZ, Chicago, Ill. The improvement is in hacksaw frames and handles, and has for its aim to produce a saw for use by machinists and others in which the blade can be readily and quickly removed for sharpening and one in which the blade when not in use can be relieved of all the strain.

POWER-TRANSMITTING MECHANISM.—W. H. SAUNDERS, Philadelphia, Pa. The principal objects of the invention are to provide a belt-driven anti-friction variable-speed counter-shaft drive which will have many advantages over those heretofore invented. The device may be constructed without great cost, to greatly reduce friction and to provide means for tightening the belt without stopping the machinery.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10188) D. E. W. says: Will you please tell me if it is a fact that there is a total eclipse of the sun every 18 years and 10 days? A. Eclipses, solar and lunar alike, occur in a period of 18 years and 11 1-3 days, very nearly. It will be 10 1-3 days if there happen to have been five leap years in the period. No one knows when this fact was discovered, but it is certain that the Chaldeans knew it and predicted eclipses by its aid. About 70 eclipses occur in this period, varying somewhat because new eclipses come in at the eastern limit and old ones disappear at the western limit. The name of this period is the Saros. Of the 70 eclipses in a Saros, there are usually 29 lunar and 41 solar eclipses; and of the 41 solar eclipses, 10 are usually total.

(10189) F. B. asks: Why do not the equal days and nights occur when the sun crosses the celestial equator? For example, in one almanac calculated for latitude 40 deg. N., on March 21 last the sun entered Aries and spring began, but the nearest equal day occurred on March 18, three days before, while in September the nearest equal day occurs on September 27, four days after. A. Equal days and nights do occur every time the sun crosses the equator. The day is just twelve hours and the night twelve hours long. But because of the equation of time the clock time of sunrise and sunset varies from six. The true sun is east of the mean or clock sun by about seven minutes in March and a little more than seven minutes to the west in September. See any good textbook of astronomy for a full explanation of this. Todd's, price $1.75, or Young's "General Astronomy," price $3, are recommended and can be supplied by us. 2. What causes the synodic revolution of the nodes of the moon, and why does the line of apsides change? A. The synodic revolutions of the moon's line of apsides and the regression of the nodes of the moon's orbit are caused by the disturbing action of the sun upon the moon. The discussion of these effects constitutes the problem of the three bodies. A good elementary presentation of the problem may be found in Young's "General Astronomy."

(10190) P. Y. asks: Suppose recording maximum and minimum pressure gage is lowered below the disturbing influence of the waves, in the open sea, during a calm, what effect will the ebb and flow of the waves have on the gages during a storm, we will say at the time when the difference is 10 feet from the normal, or 20 feet from the crest to trough? A. A pressure gage under water will show the change of pressure due to change of depth of water. It can make no difference whether the depth changes because of a wave or because of a change of depth of the gage.

If the water becomes ten feet deeper, the gage if sensitive enough will indicate that fact.

(10191) G. R. M. asks: Please answer through your paper the following questions: On a direct-current system a 16-candle-power incandescent lamp consumes ½ ampere current per hour at 110 volts = 55 watts. Does the same lamp operating on alternating current of same voltage consume an equal amount of current; that is, is lamp consumption of current equal in both cases? Why do wires carrying alternating current heat if both are not placed in same iron conduit or not concentrically wound? A. A 55-watt 16-candle-power lamp uses 55 watts on any form of current on which it can be raised so as to give 16 candles. It uses a half ampere all the time, and 55 watt-hours per hour. Wires carrying any form of current are heated by the current, producing $0.24C^2Rt$ calories, in which C is amperes, R is ohms and t is the time in seconds. This cannot be avoided by any arrangement of the wires. It is the price in calories which must be paid to get a current over a line.

NEW BOOKS, ETC.

The New Agriculture. By T. Byard Collins. New York: Munn & Co., 1906. 12mo.; 374 pages; 106 illustrations; cloth. Price, $2.

This new and authoritative work deals with the subject in a scientific way and from a new viewpoint. Dr. Collins has devoted his lifetime to the study of changing economic agricultural conditions. "Back to the soil" was never a more attractive proposition and never so worthy of being heeded as during these opening years of the twentieth century. Farm life to-day offers more inducements than at any previous period in the world's history, and it is calling millions from the desk. The reason for this is not at first obvious, and for this reason Dr. Collins has prepared the present work, which demonstrates conclusively the debt which agriculture owes to modern science and the painstaking government and State officials. Much of the drudgery of the old farm life has been done away with by the use of improved methods, improved stock and varieties. All this tends to create wealth by increased value of the product and decreased cost of production. Irrigation, the new fertilization, the new transportation, the new creations, the new machinery, all come in for a share of attention. The illustrations are of special value, and are unique. All who are in any way interested in agriculture should obtain a copy of this most timely addition to the literature of agriculture.

An Elementary Textbook of Theoretical Mechanics. By George A. Merrill, B.S. New York: American Book Company, 1906. 12mo.; pp. 267. Price, $1.50.

Prof. Merrill's well-illustrated and concise volume is intended for the upper classes in secondary schools and for the two lower classes in college. American publications upon this subject have been decidedly limited in number, and this book will probably be found to provide a long-felt want in many educational departments in this country. Each of the topics treated in the text is followed by a few examples, not many; for these examples, as in the case of the laboratory exercises, can easily be supplied by any intelligent teacher. Beyond giving due attention to the fundamental principles of teaching, no one method of presentation has been used to the exclusion of others.

Brazing and Soldering. No. 5 of a Series of Practical Papers. By James F. Hobart. New York: The Derry-Collard Company, 1906. Pp. 33. Price, 25 cents.

Wiring a House. No. 6 of a Series of Practical Papers. By Herbert Pratt. New York: The Derry-Collard Company. Pp. 21. Price, 25 cents.

A Supplement to the Books "The Milky Way" and "The Infinity of the Starry Universe." By John Lowry Adams. Sydney: Turner & Henderson, 1906. Pp. 17.

Illinois State Geological Survey. Bulletin No. 1. The Geological Map of Illinois. By Stuart Weller. Urbana: University of Illinois, 1906. 8vo.; pp. 26.

How to Do More Business. By the Author of "What a Business Man Ought to Know." London: Guilbert Pitman, 1906. 24mo.; pp. 184. Price, 40 cents.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending October 23, 1906,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Adding and multiplication machine, S. de Gomila	833,960
Adding machine cabinet, A. Hendricks	833,927
Alloy, G. F. Allen	834,090
Amusement apparatus, L. B. May	834,016
Amusement apparatus, public, B. De Mants	833,921
Amusement device, O. Henrichsen	834,065

Alcohol

Its Manufacture
Its Denaturization
Its Industrial Use

The Cost of Manufacturing Denaturized Alcohol in Germany and German Methods of Denaturization are discussed by Consul-General Frank H. Mason in Scientific American Supplement 1550.

The Use, Cost and Efficiency of Alcohol as a Fuel for Gas Engines are ably explained by H. Diederichs in Scientific American Supplement 1596. Many clear diagrams accompany the text. The article considers the fuel value and physical properties of alcohol, and gives details of the alcohol engine wherever they may be different from those of a gasoline or crude oil motor.

In Scientific American Supplement 1581 the **Production of Industrial Alcohol and its Use in Explosive Motors** are treated at length, valuable statistics being given of the cost of manufacturing alcohol from farm products and using it in engines.

French Methods of Denaturization constitute the subject of a good article published in Scientific American Supplement 1599.

How Industrial Alcohol is Made and Used is told very fully and clearly in No. 3, Vol. 95, of the Scientific American.

The Most Complete Treatise on the **Modern Manufacture of Alcohol,** explaining thoroughly the chemical principles which underlie the process without too many wearisome technical phrases, and describing and illustrating all the apparatus required in an alcohol plant is published in Scientific American Supplements 1603, 1604 and 1605. The article is by L. Baudry de Saunier, the well-known French authority.

In Supplements 1607, 1608, 1609 we publish a digest of the rules and regulations under which the U. S. Internal Revenue will permit the manufacture and denaturation of tax free alcohol.

Any Single Number of the Scientific American or Supplement will be sent for 10 cents by mail. The entire set of papers above listed will be mailed on receipt of $1.10.

Order from your newsdealer or from the publishers,

MUNN & COMPANY
361 Broadway, New York

Apparel securing device, L. W. Ashley 833,900
Atomizers, air pressure supply apparatus for, C. E. Campbell 834,185
Automobile air brake, Winton & Anderson 833,992
Automobiles, antivibration device for, G. W. Bell 833,912
Balance or weighing apparatus of the pendulum type, P. Frost 833,922
Bale tie-making machine, W. D. Ferris 834,050
Baling press, Shand & Marcus 833,753
Bed, couch, R. J. Wagner 833,903
Bee smoker, E. B. Gladish 834,121
Belt, rotary, I. N. Bate 833,911
Binder, loose leaf, T. Owen 834,163
Block mold, Julian & Brooks 833,836
Block mold, J. A. Gibson 834,052
Block molding machine, McArthur & Springer 834,155
Block signal system, L. A. Hawkins 834,129
Board cutter, tongued, J. J. & G. W. Schilling 833,942
Boat, folding or collapsible, I. O. Perring 833,846
Boats, driving gear of motor, H. C. Brasier 833,769
Boats, immersion apparatus for submarine, E. A. Nilsen 834,161
Boiler. See Steam boiler.
Boiler, H. Keller 834,137
Boiler furnace, P. Jackson 834,058
Book cover making machine, C. Leffler 834,011
Book support, J. Maccallum 833,887
Boot and shoe form, J. S. Hansen 834,053
Boring and turning mill, J. Riddell 834,218
Bottle, M. D. Lyke 834,014
Bottle filler, T. L. Valerius 833,988
Bottle opener, J. L. Sommer 833,944
Bottle stopper, S. Babic 834,038
Bottle stopper, milk, E. M. Phillips 834,075
Bottle tool, F. E. Brendel 833,823
Brake, W. E. McKay 833,844
Brake adjuster, C. A. Devanny 834,110
Brake lever, T. H. & J. W. Monahan 834,151
Brick making machine, J. D. Luttrell 834,013
Brick or block and facing therefor, building, W. B. Fenn 833,736
Bricks and the like from plastic material, molding machine for forming, G. Brown 833,952
Briquet making press, R. Martin 834,215
Broom, C. Wesner 833,766
Buckle, cross line, J. B. Carpenter 833,998
Burial casing or vault, H. D. Clark 833,773
Button, rotary locking collar, E. C. Blake 833,867
Cabinet, revolving kitchen, E. A. Clements 833,775
Caissons, etc., construction and sinking of, D. E. Moran 833,791, 833,792
Camera, H. W. Locke 833,885
Camera, W. H. Wallace 834,089
Camera plate holder attachment, H. W. Locke 833,886
Cameras, roller blind for photographic, E. Brauburger 833,916
Can screw top, E. M. Hallauer 834,125
Cans, screw top for syrup and other, W. J. Chambers 834,190
Cane unloading and feeding apparatus, F. H. Allen 833,819
Car, dumping, W. W. Wallace 834,090, 834,091
Car fender, H. Thiele 833,946
Car frames and the like, corner joint for, F. Bevan 834,103
Car, low side metal gondola, E. I. Dodds 834,004
Car, mining, E. I. Dodds 834,003
Car, motor, M. Fischer 834,007
Car stake, R. V. Sage 833,976
Car stake, combination, R. V. Sage 833,978
Car stake, extensible, R. V. Sage 833,975
Car stake, extension, R. V. Sage 833,977
Car underframe, metallic, E. I. Dodds 834,005
Carbureter, J. C. Smith 834,029
Card holding device, show, G. P. Kato, Jr. 833,743
Carousel, J. C. Reckweg 834,166
Carpet holding frame, G. W. Stickle 833,901
Cash register, J. P. Cleal 833,826
Cash register, check and [illegible] printing, J. P. Cleal 833,825
Casks, barrels, and the like vessels, apparatus for washing and cleansing lined, H. C. Russell 833,751
Catamenial garment, S. G. Schiff 833,849
Cement and manufacturing same, magnesium, W. Jeroch 833,930
Cement brick molding machine, G. Brown 833,953
Cement producing apparatus, R. C. Carpenter 833,918
Centrifugal separator, P. K. Nielsen 834,018
Centrifugal separator, J. J. Berrigan 834,043
Chair and trousers press, combined, G. W. Smith 834,083
Chalk line holder, A. N. Crawford 833,920
Channeling machine, W. Prellwitz 833,938
Cherries or the like, machine for pitting, G. W. Kiefer 834,064
Chimney cowl, A. Weber 834,092
Chopper. See Cotton chopper.
Clamp, D. Swope 833,945
Clothes drier supports, device for securing goods upon and removing the same from, W. M. Barnes 833,910
Clothes pin, Lanciaux & Saumur 834,210
Clutch, C. O. Snyder 833,982
Clutch device, A. Pentecost 834,021
Coal, vertical retort for the destructive distillation of, Woodall & Duckham 833,861
Coffee mill, A. E. Brosso, Jr. 834,105
Coil spring trap, J. Dawkins 833,827
Collar, horse, W. B. Estes 834,115
Colter, T. Machia 833,789
Concrete block machine, W. S. Barker, reissue 12,542
Concrete structures, mold for, J. Preston 833,894
Condiment holder, J. B. Williamson 834,096
Conduit, underground, H. B. Clamp 833,870
Confection forming and wrapping machine, D. T. Igou 833,785
Confection forming machine, D. T. Igou 833,786
Conveyer, F. L. Clark 833,774
Conveyer, elevated, J. W. Cooper 834,194
Cooking apparatus, V. W. Blanchard, 834,222, 834,224, 834,227
Cooking apparatus, steam, V. W. Blanchard 834,225
Corn husker, E. A. Dillavou 833,735
Corn popping machine, W. Ryan 833,899
Cotton chopper, R. A. Stuart 833,855
Cotton chopper, H. T. Johnson 834,059
Cotton elevator, C. G. Graves 833,740
Counter stiffener, J. E. Aagaard 833,862
Crustacea trap, R. M. Franklin 833,737
Crutch, E. X. Jones 834,205
Cuff holder, C. J. Warwick 833,859
Cultivator, J. Clare 833,731
Current controller, alternating, D. Larson 833,968
Current motor, alternating, C. A. Ablett 834,098
Curtain fixture, H. E. Keeler 833,837, 833,838
Curtain suspension hook, J. Carr 834,188
Danger signal, B. S. Miller 833,935
Decoy, F. J. Johnston 833,966
Delivery machine, coin freed automatic, A. Marsden 833,888
Dental structures, forming, J. A. Lentz 833,883
Dishes, machine for decorating, C. E. Bell 834,181
Door check, double acting, O. C. Rixson 833,940
Dough, etc., apparatus for molding, shaping, and compressing, J. Callow 833,824
Draft equalizer, N. Sullivan 833,984
Draft equalizer, E. Fryslie 834,117
Dredges, cutter head for suction, J. F. Ollrich 833,797
Dress preserver, B. Trenckmann 833,948
Drill, J. Murphy 834,153
Drill jig, B. T. Burchardi 833,917
Drilling tool, A. C. Shuster 834,167
Drive mechanism, G. W. King 833,839
Driving mechanism, variable speed, B. M. Ruck 833,974
Duplicator, rotary, J. Steel 833,853, 833,854
Dye, green anthraquinone, R. E. Schmidt, reissue 12,548
Egg tester, I. E. Lewis 833,788
Electric apparatus, vapor, C. P. Steinmetz 834,172
Electric motor, P. J. Collins, reissue 12,543
Electric switch, L. A. Hawkins 834,128
Electrical apparatus, making coils for, E. L. Aiken 834,220
Electrical controller, D. Larson 834,010
Electrical resistance pyrometry, E. F. Northrup 834,162
Electrical selecting appliance, C. E. Scribner 833,805
Electromagnet, H. H. Hansen 833,741
Ellipsograph, J. L. Perkins 833,892

Do You Want Good Information Cheap?

Write to us and we will refer you to a Scientific American Supplement that will give you the very data you need.

Scientific American Supplement articles are written by men who stand foremost in modern science and industry.

Each Scientific American Supplement costs only 10 cts. But the information it contains may save you hundreds of dollars.

Write for a catalogue of Supplement articles. It costs nothing.

Act on this suggestion!

MUNN & COMPANY
361 Broadway, New York

Engine reversing mechanism, compound, B. B. Petsche 833,937
Engine steering device, traction, Hall & Thomas 833,783
Etching machine, R. C. Kroll 834,144
Excavating machine buckets, cleaner for, H. Pike 833,749
Face protector, A. Hendricks 833,926
Fare register, C. E. Gierding 834,118, 834,119
Fare register bell mechanism, C. E. Gierding 834,120
Fence clamp, A. Brant 833,821
Fence posts, apparatus for making, G. A. Le Fevre 833,882
Fencing dropper, E. R. H. Edkins 834,114
Fertilizer distributer, M. Williams 833,815
Firearm, magazine, E. H. Risley 833,803
Firearm, magazine, J. M. Clough 833,872
Firearm, magazine, E. H. Risley 833,898
Firearm sight, J. Windridge 833,905
Firearms, foresight for, D. B. Kokotovic 834,143
Fish line guard, E. W. Hildreth 834,056
Fish line reel, W. E. Marhoff 833,842
Floor, A. G. Pierce 834,023
Flue cutter, W. McCormick 833,843
Fluid pressure reducing or regulating apparatus, F. Kaeferle 834,000
Fly and other insect catching device, P. W. Bailey 834,039
Friction top can, W. J. Chambers 834,191
Fruit grading machine, M. E. Wettenhall 833,991
Fruit picker, F. Kaufmann 834,207
Fuel, compound for manufacturing artificial, G. D. Piatt 833,801
Fuel economizers, header for, A. H. Blackburn 833,914
Furnace grate, S. G. Tibbs, et al 833,807
Game and apparatus therefor, J. W. Culp 833,779
Game apparatus, E. Bawden 833,725
Game apparatus, J. R. Heron 834,130
Garment supporter, I. Housel 833,928
Gas analysis, apparatus for, A. Bayer 834,040
Gas generator, G. Cothran 834,109
Gas meter, Weir & Henning 834,003
Gases in the sulfite process, recovery of valuable, E. Morterud 833,936
Gate, G. W. Crosby 833,732
Gate, J. E. Eader 834,112
Gear, reversing and speed changing transmission, J. Redding 833,802
Gear, transmission, O. W. Davis, reissue 12,544
Gearing, W. D. Rundlett 833,848
Gin roll board and feeder, W. P. Weld 834,176
Glass blowing apparatus, F. S. Lewis 834,012
Glass drawing and shaping machine, A. Raspillaire 834,165
Gluing machine, P. Kosboth 834,066
Gold extracting apparatus, J. A. Comer 833,909
Grain heater, H. F. Pietsch 833,847
Granular and like material, means for causing the movement of, S. G. Stevens 833,761
Grate bar, P. McNaughton 833,845
Grate operating mechanism, Thow & Nisbet 834,174
Grate, rocking, T. E. Martin 833,934
Grinding machine, A. Johnston 833,787
Grinding wheels, means for truing, G. E. Metcalf, reissue 12,546
Hammer, H. C. Lyon 834,149
Hammer, pneumatic, C. T. Carnahan 834,187
Hammers, work holder for power, H. C. Lower 833,969
Hand wheel, F. A. Law 833,933
Harness, J. S. McCants 834,156, 834,157
Harness pad, C. H. Grings 834,201
Harrow, disk, G. F. Malers 833,841
Harvesting machine, corn, W. H. Tilson 833,986
Harvesting machines, etc., conveying or forwarding mechanism of, D. Cave 834,046
Head rest, R. F. Truslow 833,987
Heat into work, converting, H. L. Doherty 834,006
Heating apparatus, gas, V. W. Blanchard 834,228
Heating system, A. G. Paul 833,891
Heel, boot and shoe, W. H. Taylor 834,085
Hinge, Dunn & Jennings 834,111
Hinge, gate, A. A. Adams 833,818
Hinge, screen door, J. Diehl 833,734
Hinge, spring, H. W. Steele 833,852
Hoisting apparatus, C. W. Hunt 833,929
Hoisting apparatus, W. S. Bradshaw 833,994
Holdback, J. O. Licey 833,884
Horse bit, W. Kronheim 834,236
Horse detaching device, R. J. Ellis 833,959
Horseshoe calk, detachable, G. Binder 834,183
Hose, J. S. Patterson 834,074
Hose supporter clasp, H. Binney 834,044
Hydrocarbon burner, E. C. Kahn 834,061
Hydrocarbon burner, J. F. Higgins 834,203
Ice cream freezer, T. J. Fegley 834,198
Ice creeper, H. T. Kaho 834,002
Icing machine, P. S. Guilford 834,124
Inhaler, Y. Q. Caldwell 834,184
Injector, L. E. Hogue 834,133
Insulator, F. J. Grant 833,877
Insulator, high potential, L. Steinberger 834,084
Jack. See Wagon jack.
Kitchen table, combination, W. C. Steers 834,171
Labeling machine, bottle, A. Hanke 834,126
Labeling machine, can, Rexroth & Gaynor 833,896
Lacing catch or hook, C. F. Brandt 833,915
Lamp and lantern, C. Bergener 833,951
Leaching tank, C. Voelker 834,088
Leather with coal tar, treating, L. H. Francis 834,199
Lenses, centering, A. Pellow 834,020
Level, spirit, Hicks & Franey 834,132
Leveling rod, W. L. E. Keuffel 833,880
Locomotive lubricator, J. F. McCanna 833,889
Log loader, portable, J. R. McGiffert 833,794
Log loading machine, J. R. McGiffert 833,748
Loom, filling replenishing, J. Northrop 833,796
Loom friction let-off, M. O. Steere 834,170
Loom, haircloth, G. S. Cox 834,000
Lubricating machine tools, means for, Kearney & Trecker 834,063
Lubricator. See Locomotive lubricator.
Lubricator, C. E. McCaffrey 834,068
Mail box, H. Terstegge 833,856
Mail box, L. W. Homire 833,879
Mail box signal lock, Patterson & Wiseman 833,798
Mail marking machine, W. J. Sheets 833,754
Mail signal, P. A. Gordon 834,122
Marking device, W. B. Ayer 833,820
Marking device, R. L. Herman 833,964
Match, L. B. Weissbrod 834,094
Match safe, T. A. Hazleton 833,925
Matrix truing apparatus, H. C. Hansen, reissue 12,545
Measuring leather, etc., instrument for, Robertson & Delaney 833,941
Meat roasting device, C. Mannheim 833,970
Metal working machines, feeding mechanism for, G. L. Brownell 833,770
Metals from ores, apparatus for separating, R. K. Evans 834,233
Milking animals, apparatus for mechanically, C. S. Padfield 833,890
Millboard making machine, W. Sillman 833,806
Miter box, W. J. Parsons 834,073
Mitering machine, W. C. Kantner 834,206
Mixing machine, W. Miles 833,790
Mold, F. M. White 833,814
Motor control, automatic, S. H. Libby 834,147
Motors, apparatus for operating reciprocating hydraulic, A. H. Johnson 833,931
Mower, lawn, G. H. Bryan 833,996
Musical instrument, mechanical, G. P. Brand 833,995
Musical instrument or player, automatic, P. B. Klugh 833,967
Musical instruments, machine for perforating paper and metal sheets for use in playing, W. W. Colley 834,103
Nailing implement, J. Malmgren 834,214
Needle, tape, G. B. Payne 833,799
Nuts, ball bearing gland for packing, W. W. Hicks 833,784
Oar, bow facing, W. C. Case 833,730
Ore separator and classifier, magnetic, G. H. Waring 834,175
Ornament making machine, C. A. Maddox 834,213
Oven, cooking, J. McGuire 834,159
Oven, cooking, V. W. Blanchard 834,231
Packing, metal, R. Kube 833,932
Packing, stuffing box, S. M. Guss 833,961, 833,962
Padlock, S. R. Slaymaker 834,027
Pail stand, detachable, N. H. C. Pihl 833,800
Paper box, F. Knobeloch 834,142
Paper box machine, J. H. Shearn 834,080
Paper trimming and pasting machine, wall, J. Vogt 834,087
Partition block, A. G. Pierce 834,024

Inexpensive Classified Advertisements

Advertising in this column is 50 cents a line. No less than four nor more than ten lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

SALE AND EXCHANGE.

AN AMATEUR would like to dispose of X-Ray and other electrical apparatus. All in excellent condition. Reason for selling, lack of time to devote to experimental work. Sell very reasonably. D. S., Box 773, N. Y.

FOR SALE.—West Virginia Coal and Timber Lands, on and near Norfolk & Western Railroad. For further particulars regarding this sale address F. G. Grove & Bro., Luray, Va.

WE MANUFACTURE METAL SPECIALTIES of all kinds. Best equipment. Send sketch or model for estimate, stating quantity. Hayes Manufacturing Co. 465-75 Maybury Avenue, Detroit, Mich.

FOR SALE.—Engine Lathe, swings 9¼ in. takes 25 in. between centers; complete with full set change gears to cut all size threads, 3 to 40 in.; price only $41.00. Address L. F. Grammes & Sons, Allentown, Pa.

PATENT FOR SALE.—I want to sell outright the proprietary rights in my new Improved Metal Fence Post, sure to be used in all parks, farms and gardens. C. C. Dolan, 324 Green Street, Lockport, N. Y.

FOR SALE.—Patented novelty. Medallion and Match Igniter. No. 762,849. Should be rapid seller, made cheaply, and a money getter. Will receive bids for same up to November 1. F. B. Shepard, Gloversville, N. Y.

BUSINESS OPPORTUNITIES.

MOTION PICTURE MACHINES, Film Views, Magic Lanterns, Slides and similar Wonders For Sale. Catalogue Free. We also Buy Magic Machines, Films, Slides, etc. T. S. Harbach, 809 Filbert St., Philadelphia, Pa.

A FEW DOLLARS will start a prosperous mail order business. We furnish catalogues and everything necessary. By our easy method failure impossible. Write today. Milburn-Hicks Co., 718 Pontiac Building, Chicago.

WE WISH TO CORRESPOND with some firm or person who have the financial standing and business prestige to handle a perfect non-filling bottle. One that can be made and sold for two cents more than the ordinary bottle and leave a good profit. For particulars, addres George Brothers, Dixon, Ill.

ZELNICKER MARKING CRAYONS are longer, better, cheaper. Won't wash or brush off. To introduce will send once only, postpaid, six of any color desired for 40 cents. Zelnicker Crayon Works, St. Louis.

EXPERIMENTAL CASTINGS of Soft Gray Iron from loose patterns; any weight up to fifty pounds each. Price 15 cents per pound. Minimum charge $1.00. Send patterns prepaid with remittance. Special prices quoted on large quantities from gated patterns. Grey Iron Novelty Co., Columbia, Pa.

REINFORCED CONCRETE.—A man with $15,000 to $20,000 may secure an interest in an established business. For further particulars, address Concrete, Box 773, New York.

INVENTORS seeking to put upon the market novelties, cutlery, sporting, toilet, etc., articles, send descriptive picture, drawing, etc., to Arthur Leiscester, West New Brighton, New York.

WANTED, BOOKS.—The Scranton International Library of Technology, Vols. 1-to 81. Must be latest edition and in good condition. Address, stating lowest price for cash, The Librarian, State Agricultural College, Agricultural College P. O., Michigan.

AUTOMOBILE EXPERTS are in constant demand at high salaries. Our six weeks' course is the most thorough and practical, fitting men to drive, handle and repair. Day and evening classes. Special course for owners. New York School of Automobile Engineers. 146 West 56th Street, New York.

INSTRUCTION.—Private, practical instruction in the Engineering use of Algebra, Geometry, Logs, Trigonometry, Sliderule, etc. Write Geert Blaauw, 111 East 7th Street, New York City.

POLARITY INDICATOR, VEST POCKET SIZE. Indicates the poles instantly; warranted. Needed by every electrician; 50 cents by mail. For further particulars address M. L. Kirkford, West Haven, Conn.

I AM LOOKING FOR A GOOD PATENT ARTICLE to push. Must have merit. Only full particulars noticed. Address W. B. Westerfield, 420 West 145th Street, New York City.

WANTED.—To correspond with parties desiring to develop and manufacture an invention of merit connected with the automobile industry. Address H. O. Fletcher, Hyde Park, Mass.

HELP WANTED.

SPECIALISTS.—The demand for specialists exceeds our supply; the more out-of-the-ordinary your ability the better our facilities for marketing it. Call or write to-day. Hapgoods, 305 Broadway, New York.

BOOKS AND MAGAZINES.

MAGAZINES, Newspapers and all periodicals at lowest club prices. Our catalogue contains a list of 3,000 periodicals and combination offers. A handy magazine guide, 40 pages and cover, sent Free for the asking. Bennett's Magazine Agency, 68 La Salle St., Chicago, Ill.

SITUATIONS AND PROFESSIONAL OPENINGS.

EXPORT ADVERTISING SOLICITOR WANTED. —An advertising solicitor having had long experience on export business can have a valuable position with a well-known export medium on proving his ability. Address Export, Box 773, New York.

PATENTS FOR SALE.

FOR SALE.—U. S. PATENT 804,666, also for various foreign countries, on Copy and Book Holder. Business partly worked; promises fortune. A. Merceret, 47 W. 16th St., New York City.

PARTNERS WANTED.

PARTNER WANTED.—Interest in old established Patent business for sale at $5,000. Rare opportunity for young man with technical training to learn this profitable business. For further information address T. S. Crane, 70 Nassau Street, New York.

SENSITIVE LABORATORY BALANCE

By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp. The balance can be made by any amateur skilled in the use of tools, and it will work as well as a $125 balance. The article is accompanied by detailed working drawings showing various stages of the work. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1184. Price 10 cents For sale by MUNN & Co., 361 Broadway, New York City, or any bookseller or newsdealer.

Paste applying apparatus, W. L. Marsh.... 833,747
Pencil attachment, R. A. Koehler........ 833,744
Percussive device, J. Murphy........ 834,152
Photographs, material for printing multiple, H. C. J. Deeks........ 834,048
Photography, frame with triple plate-holders for color, J. Frachebourg........ 833,782
Piano, F. Gehring........ 833,923
Piano card punching machine, R. Johnston 834,136
Pile fabric, woven, E. S. Craddock........ 834,001
Piling, sheet, L. P. Friestedt........ 834,051
Piling, sheet, C. C. Tomkinson........ 834,086
Pin. See Clothes pin.
Pipe wrench, A. Meierhoff........ 834,216
Planter carriage, double row, E. G. Graves 833,831
Plastering device, N. C. Petersen........ 833,893
Plastic composition, J. E. Beck........ 834,101
Plate and tablet holder, division, T. C. Belding........ 833,768
Plow, clay cutting, J. B. Hall........ 833,832
Plow marking attachment, W. H. Sutton.. 834,030
Plows and the like, hitch for, J. Tauscher 833,902
Pocketbook, C. L. Hille........ 833,834
Power operated brake, F. E. Case........ 834,107
Power transmission mechanism, C. P. Smith 834,082
Printing press, J. F. Ames........ 833,908
Printing press, A. B. Sherwood........ 834,026
Printing presses, support for paper fed to, E. W. Carpenter........ 833,997
Propeller wheel, N. R. Smith........ 833,850
Propellers, pitch lock for reversible, B. N. Pierce........ 834,076
Pulp, manufacture of chemical or sulphite wood, R. Roe, Jr........ 833,750
Pulp screen, F. M. Chapman........ 834,192
Pumping system, M. R. Muckle et al., reissue........ 12,547
Punch, blacksmith's, J. F. Kidder........ 834,139
Punch, multiple, L. H. Vold........ 833,811
Puzzle, H. H. Knoll........ 834,065
Rack, F. G. Hoerlein........ 834,057
Radiator, Thissen & Vander Putten........ 833,857
Rail column, hand, J. C. Lyle........ 833,746
Railway automatic couplings, lock lifters for, T. Welch........ 833,812
Railway crossing, C. M. McFatridge........ 834,158
Railway, gravitation, J. Thompson........ 833,762
Railway, gravity, L. F. Huntley........ 833,835
Railway rail, S. W. Carter........ 833,919
Railway signal system, M. G. Voigtlander. 833,765
Railway structure, J. A. Shirley........ 833,755
Railway tie, A. S. Glasford........ 833,739
Railway tie, W. O. Smith........ 833,851
Railway tie, E. H. Bell........ 833,913
Range, gas, V. W. Blanchard........ 834,230
Ratchet wrench, G. H. Young........ 834,219
Razor blade holder, H. S. Phillips........ 834,022
Razor, safety, F. H. Arnold........ 833,767
Razor strop, F. L. Brunswick........ 833,728
Reefing tool, A. F. Bowen........ 833,869
Refrigerator cars, slatted partition for, C. Setzekorn........ 833,752
Register, W. L. Carter........ 833,871
Regulating apparatus, E. A. Sperry........ 833,760
Resilient wheel, T. W. Broomell........ 834,106
Riveters, holder-on for, E. Gunnell........ 833,878
Rock drill, H. Deitz........ 833,875
Rocking chair, J. E. Nutter........ 834,070
Rotary engine, H. Tuttle........ 834,033
Rotary engine, C. J. Duncan........ 834,049
Sad-iron, E. Smith........ 833,943
Sad-iron heater, V. W. Blanchard........ 834,182
Sand blast apparatus, Loughman & Hess.. 834,067
Sanding device, J. W. Folzey........ 834,116
Sandpapering machine, E. J. Bein........ 833,726
Sardine can, tongueless key opening, H. B. Williams........ 834,178
Sash check or lock, I. G. Sigler........ 833,900
Sash lock, C. S. Wray........ 834,097
Saw swage shaper, V. H. & A. K. Hanchett 834,009
Saw tooth, C. M. Datterway........ 834,196
Sawmill setting apparatus, E. H. Percy, Jr. 833,972
Scale, O. T. Boulton........ 833,868
Scale, weighing, Cochran & Plumtree........ 833,873
Scale, weighing, Cochran & McCabe........ 833,874
Screw top can, S. Tevander........ 834,173
Seal, car, O. B. Emerson........ 834,197
Seal, car, Greene & Emerson........ 834,200
Seesaw, H. T. Kingsbury........834,140, 834,141
Sewer opener, D. Hymes........ 834,135
Sewing machine foot, shoe, F. W. Parkhurst........ 834,072
Sewing machine needle and shuttle guard, Corcoran & Dobyne........ 833,954
Shade adjuster, window, A. A. Schramm.. 833,804
Shade and curtain support, combined, F. Eckert........ 834,113
Shaft hanger, C. G. Harrington........ 833,963
Shaft, vehicle, T. D. Toy........ 834,031
Shafting, H. K. Sandell........ 833,979
Shaking table, G. Carlson........ 834,186
Shelf, adjustable, B. J. Whitcomb........ 834,095
Shelf, rotatable delivery, T. Van Kannel.. 833,810
Ship construction, Harroway & Dixon, 834,127, 834,234
Sighting machine, B. A. Fiske........ 833,781
Sign, automatic changeable, Thomas & Gillette........ 833,985
Sign, electric, A. C. Heiny........ 834,235
Signal. See Danger signal.
Skirt hanging gage, A. H. & L. O. Turner 834,032
Slate cutting machine, F. S. Derr........ 834,002
Smoker's compartment box, B. A. Reynolds 833,897
Smut machine, W. H. Thompson........ 833,947
Snow guard and fender, H. N. & R. H. Sieger........ 834,081
Soap in water, emulsifying resin, M. Erfurt, reissue........ 12,540
Socket member, J. V. Washburne........ 834,035
Soldering machine, can, C. B. & C. D. McDonald........ 834,060
Spark gap and muffler therefor, Harrison & Haslett........ 834,054
Sparking plug, D. W. Wilson........ 834,179
Speed differentiator, F. H. Cheyne........ 833,772
Speed indicator, E. H. Riordan........ 834,079
Speed varying apparatus, L. A. Lohr........ 834,212
Spoon, mixed drink, A. L. Smith........ 834,028
Spring wheel, A. Ellis........ 833,828
Stacker, hay, J. R. Wright........ 834,180
Stage scenery, automatic fire drop for, H. C. Barrow........ 833,993
Stamping device, H. E. Johnson........ 833,742
Steam boiler, F. B. Hibbard........ 834,131
Steam boiler, V. W. Blanchard........ 834,221
Steam engine, rotary reversible, J. H. D. Beaucage........ 834,041
Steam generator, J. W. Eisenhuth........ 833,780
Steam or other fluid pressure motor, W. V. Turner........ 833,809
Steam trap, T. J. Cookson........ 833,777
Stool, piano, S. S. Broughton........ 833,771
Stove and range, gas cooking, V. W. Blanchard........ 834,229
Stove, gas burning heating and cooking, V. W. Blanchard........ 834,223
Stretcher, J. L. Claudin........ 834,232
Stripping and cleaning machine, E. Behrendt........ 834,102
Sugar goods, machine for making, A. Vosskohler........ 834,034
Sunbonnet, C. E. Yount, Sr........ 833,950
Surgical instrument, J. D. Sourwine........ 833,759
Surgical instrument for amputation of the rectum, C. G. Crumrine........ 834,047
Surgical sewing instrument, P. Behr........ 834,042
Suspenders, C. A. Murray........ 834,154
Switch indicator, automatic, E. F. Coffin. 833,776
Switch operating apparatus, N. Silverson.. 834,168
Switch operating mechanism, H. J. Auger 833,863
Switchboard connecting cords, fastening device for, E. B. Craft........ 833,778
Talking machine horn supporting crane, Hawthorne & Sheble........ 834,202
Target trap, C. D. Linderman........ 834,211
Telegraphic code, D. H. Wilcox........ 833,904
Telephone bracket, C. H. Borden........ 834,104
Telephone circuit signaling apparatus, J. G. Wray, et al........ 833,816
Telephone switching and busy-test apparatus, J. G. Wray, et al........ 833,906
Telephone switching and signaling apparatus, J. G. Wray, et al........ 833,817
Telephone system, W. W. Dean........ 833,733
Telephone system, C. V. Beaver........ 833,866
Telephone system, Kenney & Leather........ 834,208
Telephone toll lines, signaling apparatus for, J. G. Wray, et al........ 833,907

Telephone transmitter arm, J. A. Loff	833,745
Textile frames, differential traverse bar for, W. Monk	834,017
Therapeutic apparatus, E. Kromayer	834,209
Threshing machine band cutter and feeder, T. L. Cummings	834,195
Tile press, F. Mueller	833,793
Tire, detachable pneumatic, C. S. Scott	833,981
Tire, rubber, A. H. Marks	834,015
Tobacco pipe, C. Wolff	834,036
Tobacco pipe, Weller & Spotswood	834,177
Toy, E. C. Reiter	834,077
Trace, S. Shisler	833,757
Trace, harness, S. Shisler	833,756
Trace holder, F. J. Fisk	833,876
Track sander, F. B. Corey	834,108
Transformer, C. E. Lord	834,148
Transformer, L. C. Nichols	834,160
Transmisson mechanism, J. Henrikson	833,833
Tray, J. B. Arthur	834,037
Trolley base, H. Holland	834,134
Trolley system, overhead, C. E. Barry	834,100
Truck, A. D. Hanna	833,924
Truck, automobile, H. B. Lewis	834,146
Truck, car, C. T. Westlake	833,813
Truck, car, W. G. Price	833,895
Turbine, balanced steam, W. L. Webster	833,990
Turbines, shaft bearing for elastic fluid, R. H. Rice	834,078
Twine holder and take-up, J. L. Orr	834,019
Type composing and justifying machine, A. Dow	833,956
Type setting and justifying machine and the art relating thereto, A. Dow	833,955
Typesetting machine, A. Dow	833,957
Typesetting machine, W. P. Quentell	834,164
Typesetting machine, case-handling device for, A. Dow	833,958
Typewriter escapement mechanism, C. J. Paulson	833,971
Typewriting machine, E. F. Kunath	833,840
Typewriting machine, Barron & Merritt	833,864
Typographic machine, A. Greenleaf	834,123
Umbrella, T. B. Abbott	833,724
Valve, W. K. Omick	834,071
Valve gear, duplex, P. F. Oddie	834,217
Valve, straightway, W. T. Rider	833,939
Valve, throttle, G. B. Petsche	833,973
Valve, triple, Inches & Hosker	833,965
Vault, burial, E. C. Hodges	834,204
Vehicle, motor, M. Grier	834,008
Vehicle spoke boot, J. T. Mills	834,150
Vehicle storm cover, H. D. Pursell	834,025
Vehicle wheel, W. G. Titherington	833,763
Veneer barrels, machine for making, W. R. Stokely	833,983
Wagon body lifter, J. N. Smith	834,169
Wagon box, R. G. & L. Cator	834,045
Wagon dump, H. C. Tripp	833,764
Wagon jack, J. F. White	833,949
Wagon jack, C. P. Sester	833,980
Wagon stake, H. Keller	834,138
Warping machine, S. W. Wardwell	833,989
Washboiler drainer, W. J. Burge	833,729
Watch stem, J. F. King	833,881
Water elevator, J. J. West	833,860
Water heater, V. W. Blanchard	834,226
Water, heating, purifying, and regulating, J. W. Gamble	833,829
Water, means for purifying and regulating a supply of, J. W. Gamble	833,830
Wheel. See Hand wheel.	
Whiffletree hook, W. True	833,808
Whist, implements to be used in playing duplicate, F. W. Chadbourne	834,189
Wick stop, J. S. Frey	833,738
Window frame and sash, metallic, M. Berwanger	833,727
Window, pivot, L. M. Neabrey	833,795
Window screen, T. Landsberg	834,145
Wire straightening and cutting machine, F. B. Shuster	833,758
Woodworking machinery, feeding device for, J. R. Thomas	833,858
Wrench, W. A. Beason	833,865
Yoke, neck, P. E. Breckheimer	833,822

DESIGNS.

Candlestick, K. Booth	38,293
Card, playing, A. Lee	38,295
Fabric, knitted, F. Conde	38,297
Knife and fork, combination, F. McClure	38,292
Pillow cover, leather, Coulson & Dodenhoff	38,296
Scarf pin or similar article, H. W. Sherrill	38,291
Sign, G. A. Reach	38,294

TRADE MARKS

Acid and salts thereof, oxalic and lactic, American Acid & Alkali Co.	56,884
Ale, Anheuser-Busch Brewing Association	56,860
Anodynes in liquid form, E. T. Krebs	56,873
Bats, base ball, J. F. Hillerich & Son	56,894
Bearings, roller and ball, Bantam Anti-Friction Co.	56,912
Beer, Anheuser-Busch Brewing Association, 56,861 to 56,863,	56,911
Beer, Reisch Brewing Co.	56,934
Bitters, Union Wholesale Liquor Co.	56,902
Bitters, stomach, Wichman, Lutgen & Co.	56,907
Blowers and forges and attachments thereto, Champion Blower & Forge Co.	56,916
Bones, dress and corset, J. Janowitz	56,926
Boots and shoes and leather used in their manufacture, leather, Rice & Hutchins	56,944
Bottle washing machines, Hoyt Brothers & Co.	56,924
Bread, W. H. Crounse	56,823
Bread and cake making and egg beating machines, Landers, Frary & Clark	56,846
Bread, pies, cakes, etc., Skillman Bread & Pie Co.	56,832
Brushes and buffs, polishing, F. W. Gesswein Co.	56,812
Butter, Continental Creamery Co...56,818 to	56,820
Cakes and crackers, G. H. Schmidt	56,856
Candy and candied popcorn, Rueckheim Bros. & Eckstein	56,880
Canned fruits and vegetables, Sprague, Warner & Co. 56,834,	56,835
Canned vegetables, Bruns Bros. Gro. Co.	56,840
Cantaloups, A. F. Young & Co.	56,948
Champagne, Acker, Merrall & Condit Co.	56,858
Cheese, Popper, Gray & Co.	56,831
Chemicals, certain named, Brunner, Mond & Co.	56,887
Chocolate and cocoa, pulverized or powdered, F. Bischoff	56,865
Cigars, E. Abe	56,810
Clay pigeons, Chamberlin Cartridge & Target Co.	56,888
Cleaning and polishing metal, glass, marble, and the like, material for, Matchless Metal Polish Co.	56,814
Cleansing or scouring compound, Enoch Morgan's Sons Co.	56,811
Coffee and spice mills, Landers, Frary & Clark	56,847
Coffee substitute, Dr. Shoop Family Medicine Co.	56,825
Compounds for calming excited nerves and curing spasms, Tilden Co.	56,901
Corsets and petticoats, H. T. Sykes	56,837
Cotton on spools or reels, sewing, Jas. Chadwick & Bror	56,927
Crayons, school and artists', American Crayon Co.	56,940
Cream, cold, R. Hudnut's Pharmacy	56,854
Cream separators, De Laval Separator Co.	56,918
Culinary article made of tinware, Reed Manufacturing Co.	56,853
Dental chairs, Ritter Dental Mfg. Co.	56,946
Drills, reamers, taps, dies, counterbores, and milling cutters, Morse Twist Drill & Machine Co.	56,932
Dyestuff, Badische Anilin & Soda-Fabrik	56,885
Edge tools, certain named, Buck Bros.	56,914
Electrical wire, rubber covered, John A. Roebling's Sons Co.	56,844
Fertilizers, Virginia-Carolina Chemical Co.	56,817
Fishing lines, T. J. Conroy	56,917
Flour, wheat, Dorsel Co.	56,824
Flour, wheat, New Century Milling Co.	56,830
Flour, wheat, John A. Cole Milling Co.	56,843
Flour, wheat, Central Kansas Milling Co.	56,866
Flour, winter wheat, Standard Milling Co.	56,836

ROTARY PUMPS AND ENGINES. Their Origin and Development.—An important series of papers giving a historical resume of the rotary pump and engine from 1588 and illustrated with clear drawings showing the construction of various forms of pumps and engines. 38 illustrations. Contained in SUPPLEMENTS 1109, 1110, 1111. Price 10 cents each. For sale by Munn & Co. and all newsdealers.

RADIUM AND THE RADIO-ACTIVE Substances. No better or clearer scientific account has been published than that contained in SCIENTIFIC AMERICAN SUPPLEMENT 1429. The paper presents all that is at present known about radium and the radio-active substances. Price 10 cents, by mail. Munn & Co., 361 Broadway, New York City and all newsdealers.

Food choppers, rotary, Landers, Frary & Clark 56,848
Food made from wheat, breakfast, Cream of Wheat Co. 56,821, 56,822
Gin, Weideman Co. 56,905
Gloves, leather, V. Perrin & Cie 56,878
Gluten feed and dried distillery slops, J. Marcus 56,850
Hair tonic, Dr. D. Jayne & Son 56,895
Hammers, Hibbard, Spencer, Bartlett & Co. 56,922
Hatchets, adzes, axes, and pocket knives, Wells & Nellegar Co. 56,938
Hay carriers, F. E. Myers & Brother 56,933
Hosiery of every description, Rubens & Meyer 56,935
Ice cream freezers, Richmond Cedar Works 56,945
Ironware, enameled, J. M. Kohler Sons Co. 56,925
Jeans, Jefferson Woolen Mills 56,928
Knitted shirts, drawers, vests, and pants, Fred W. Millington 56,920
Lard, Armour & Co. 56,864
Lead, white, National Lead Co. 56,815
Leather, shoe, A. Trostel & Sons 56,947
Locks, padlocks, and keys, Miller Lock Co. 56,831
Macaroni, spaghetti, and vermicelli, John B. Canepa Co. 56,828
Matches, safety, Jonkopings och Vulcans Tandsticksfabriksaktiebolag 56,897
Meat and vegetable choppers, rotary, Landers, Frary & Clark 56,930
Meats and lard, certain named, John P. Squire & Co. 56,929
Medicinal plasters, Allcock Manufacturing Co. 56,883
Medicine for women's diseases, J. H. Blake. 56,886
Medicines, certain named, I. A. McKenney. 56,899
Mustard, D. & L. Slade Co. 56,867
Oats, rolled and ground, H-O (Hornby's Oatmeal) Co. 56,827
Oils, lubricating, Valvoline Oil Co. 56,816
Paints, mixed, Hibbard, Spencer, Bartlett & Co. 56,813
Perfumery, Jordan Marsh Co. 56,898
Perfumes, liquid and powdered, R. Hudnut's Pharmacy 56,855
Pharmaceutical preparations, certain named, J. F. Johnson 56,896
Photographic film, sensitized, Eastman Kodak Co. 56,919
Pipe lengths, Central Foundry Co. 56,915
Razors and razor blades, Gillette Safety Razor Co. 56,921
Relishes, certain named, M. A. Gedney Pickling Co. 56,829, 56,849
Remedies for certain named diseases, L. M. Mentele 56,931
Remedy, anti-rheumatic and gout, S. Penny 56,877
Sauce, Gebhardt Chili Powder Co. 56,826
Saw and nail sets, Hibbard, Spencer, Bartlett & Co. 56,923
Shirtings, osnaburgs, denims, and canton-flannel, cotton, Massachusetts Cotton Mills 56,875
Shirtings, sheetings, cambrics, and long cloth, G. Willis & Co. 56,939
Shoes, leather, J. G. Grieb & Sons..56,942, 56,943
Skin food in liquid form, F. Herb 56,893
Soap, Fels & Co. 56,841
Stoves, burners, and ovens, gasolene or vapor, American Stove Co. 56,910
Tea, S. C. Smith & Co. 56,833
Telescopes, F. B. Warner 56,857
Thread, sewing, Jas. Chadwick & Bror 56,842
Tires, rubber, Goodyear Tire & Rubber Co. 56,941
Tonic beverages, carbonated, Reavis Distributing Co. 56,879
Tonic vermifuge, Dr. D. Jayne & Son 56,870
Trousers, Jefferson Woolen Mills 56,871
Uniforms, naval, military, society, and theatrical, Wm. H. Horstmann Co. 56,838
Valves for radiators, air-vent, Norwall Manufacturing Co. 56,852
Veterinary medicine and liniment, C. E. Keough 56,845
Watch cases, Dueber Watch Case Mfg. Co. 56,890
Water, mineral, Manacea Water Co. 56,874
Waterproof preparation, liquid, W. H. H. Boylan 56,839
Whisky, Geo. Benz & Sons 56,868
Whisky, Hill, Thomson & Co. 56,869
Whisky, A. Overholt & Co. 56,876
Whisky, Chapin & Gore 56,889
Whisky, Francis Kelly & Co. 56,891
Whisky, J. Harbinson 56,892
Whisky, B. J. Semmes & Co. 56,900
Whisky, Weidemann Co. 56,903, 56,904
Whisky, William Wolff & Co. 56,908
Whisky, Wm. Bergenthal Co. 56,909
Whisky, Boehmke Wine Co. 56,913
Whisky, Irish, Weideman Co. 56,937
Whisky, Scotch, John Burke Importing Co. 56,872
Wine, Schlesinger & Bender 56,936
Wines, Wetmore, Bowen Co. 56,906
Wood preserving compound, chemical, American Wood Preserving Co. 56,859
Yeast, Aktienbrauerei zum Lowenbrau in Munchen 56,882

LABELS.

"Carnation," for catsup, M. E. Stohrer .. 13,135
"Dr. Daniels' Veterinary Physic Ball," for medicine, Dr. A. C. Daniels 13,140
"Eagle," for paper bags, Crown-Columbia Pulp & Paper Co. 13,142
"El Ranchero," for cigars, W. J. Lytle 13,130
"John Taylor's Pork Roll," for pork roll, Taylor Prov. Co. 13,134
"Kee-Za," for tea, Cobb, Bates & Yerxa Co. 13,131
"Kee-Za," for coffee, Cobb, Bates & Yerxa Co. 13,132
"Madam Drake's Hair Restorer," for a hair restorer, Houseman's Pharmacy 13,139
"Magic Curler," for hair curlers, Magic Curler Co. 13,138
"Perfecta Massage Cream and Skin Food," for a massage cream and skin food, C. O. Rano 13,137
"Piedmont," for evaporated apples, Wallerstein Produce Co. 15,133
"Reliance," for paper bags, Crown-Columbia Pulp & Paper Co. 13,141
"Sirenia," for whips, United States Whip Co. 13,144
"Snowflake," for paper bags, Crown-Columbia Pulp & Paper Co. 13,143
"The American Princesses' Roman and Grecian Massage Bath and Toilet Compounds," for toilet and massage compounds, E. H. Green 13,136

PRINTS.

"Cream of Wheat," for a cereal breakfast food, Cream of Wheat Co. 1,819
"The Baxter Shoe," for shoes, Holland & O'Brien Shoe Co. 1,822
"The Mannion Shoe," for shoes, Holland & O'Brien Shoe Co. 1,821
"Xmas Stocking," for Christmas stockings, Elms & Co. 1,820

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

ELECTRIC LAUNCH MOTOR — THE design in this paper is for a motor of unusual simplicity of construction, which can easily be built by an amateur at small cost. It is intended for a boat of about 24 feet over all and 4 feet 6 inches beam, drawing 18 inches, and is capable of propelling such craft at a speed of 7 miles per hour. Illustrated with 21 cuts. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 1202. Price 10 cents by mail, from this office and from all newsdealers.